THE IRON TRADE REVIEW

VOLUME XXIX. CLEVELAND, O. MARCH 12, 1896 CHICAGO, ILL. NUMBER 11.

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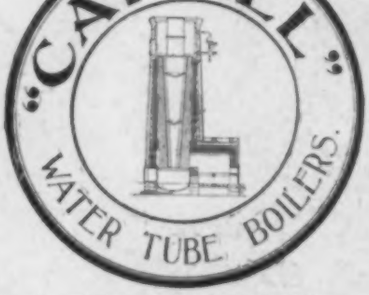

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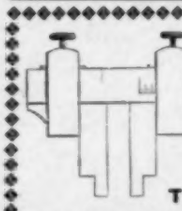

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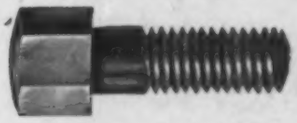

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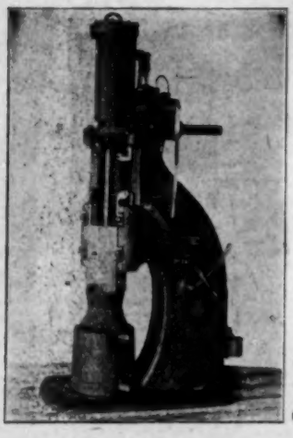

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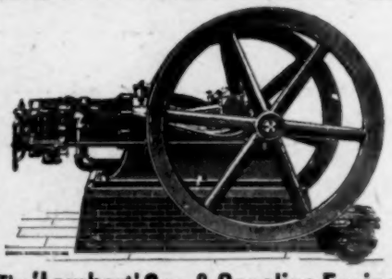

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THE IRON TRADE REVIEW

VOLUME XXIX. CLEVELAND, O. MARCH 12, 1896. CHICAGO, ILL. NUMBER 11.

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

Quietness that has not been more marked since the beginning of the year has prevailed in all iron and steel markets the past week. The same weakness noted in our last report exists in pig iron; finished material shows no new development as to prices or demand. Plates, sheets and bars show more inclination to weaken than other lines. In the case of the last named, wage reductions will be in force through March and April, the drop in puddling being from $4.50 to $4 a ton. Structural material as noted week by week, continues full of promise. Last year April was well along before things really began to move and some satisfaction is being derived from that record, in lieu of any indications thus far that March is to be a better month than February. The probability that another week will bring a definite announcement concerning Bessemer ore prices, and the general belief that the basis will be in the neighborhood of $4 for standard Gogebic hematites, have no effect on the market for Bessemer pig. It is well agreed that this iron is a good investment, at the prices made in recent prompt sales, but the restriction of credit is a dominating influence for the time being. Iron that must be turned into money is therefore sold at a price that takes little account of cost, much less of prospective cost. Demand from consumers of Bessemer iron is still wanting—as $17.25 for billets at Pittsburg would indicate—and the quotation of $11.40 to $11.65 for Bessemer in the valley, or $12.15 to $12.40 Pittsburg, established by two or three recent prompt sales to realize, still stands, though $12 to $12.50 in the valley is the figure of buyers who can finance the piling of their iron. The demand for foundry grades has been of slender proportions. Buyers who covered a part of their wants in January find that they can now buy at $1 a ton less and are naturally chary of taking hold. It may be expected that only immediate wants will be satisfied by the majority of buyers until there are evidences of a fresh start. The record of increased stocks of all kinds of iron in February was only what the trade had anticipated. Foundry operations have been on a moderate scale; perhaps the West has fared better than the East on general machinery castings. Cast iron pipe works in all sections have good prospects and 1896 is counted on to bring as large a tonnage as 1894, which was a record making year. The small sales of foundry iron in the past two weeks have shown that both Northern and Southern producers are freely shading quotations to hold their trade, or to get especially desirable tonnage. On No. 2 foundry the equivalent of $8 Birmingham has been shaded, as has $11.75 at valley furnaces.

THE CLEVELAND DISTRICT.

The announcement of Bessemer ore prices for 1896 is not likely to be long delayed. It may come before the end of another week. There appears to be no foundation for the report that any new disagreement as to allotments has come up; that question was settled two months ago. While the price is not believed to be absolutely fixed, there is no reason to change the prediction that it will fall close to $4 for standard Gogebic hematites. Unless there is a very radical change in conditions the expectation of vesselmen that 12,000,000 tons of ore will be moved this year may be disappointed. The chances are that early season-chartering will not be plentiful. It is known that considerable business could be done at $1.10, but shippers are not disposed to offer more than $1. With both sides reasonably firm, the freight market is likely to be a waiting one. Vesselmen are influenced largely by the record of 1895, which far outran the early predictions of well-posted shippers. On the other hand the exceptionally light shipments from Lake Erie docks to furnaces in January and February are to be considered—the smallest total in years. Furnaces took forward direct, in the season of 1895, all the ore they could make room for, and while the amount on dock Dec. 1 was less than on the same date in 1894, the total on May 1 this year is not expected to be much, if any, below that for May 1, 1895.

Pig Iron. No change for the better can be announced, either for Bessemer pig or for foundry grades. The necessities of furnaces on the one hand, and on the other hand a few sales calling for March deliveries, made two or three months ago by middlemen, are the conditions that lead to an occasional prompt sale. The average furnaceman cannot meet the prices reported in such connections. While $12.25, Cleveland, could be done, and one valley sale at 10 cents less has been made, other furnaces quote $12.50 in the valley. But steel works are not in need of iron, and with the expected starting up of two Duquesne furnaces in May, able to produce as much as five average valley furnaces, the opportunity for independent producers to market their product will be considerably lessened. Foundry irons are uncertain as to price. Some No. 2 has sold as low as $11.50 in the valley, or $12.25 Cleveland, but the common quotation is $12 in the valley. The size and desirability of the order govern entirely. With the weakening in price there is also some disposition to extend deliveries. Buyers are following the market closely and are only buying as their wants compel. Forge is quoted $11 to $11.15 Cleveland. Lake Superior charcoal is very dull. We quote $13.50 to $14.

Finished Material. Several building projects in Cleveland and at other Northern Ohio points promise a moderate tonnage of structural material in the next few months, but present business in beams and channels is light. The quotation of 1.54c Cleveland is maintained. Bridge work taken by several Ohio concerns has called for several hundred tons of plates and shapes in the past week. Plates are still quoted at 1.44c Cleveland for tank, but this price has been shaded on 3-16 and ¼ inch material. Bars are weaker, and while 1.20c Cleveland for steel is quoted, competition between Cleveland and Pittsburg mills for business in intermediate points has brought a Pittsburg quotation of 1.10c. Bar iron has not yet broken its record of inactivity. The reduction in wages is not of great significance; the amount of iron puddled at the $4 50 rate of January and February having been of very small proportions. Local wire and wire nail mills are feeling the activity that comes at this season, but rods are not in demand. The nominal price is $23. Billets are quoted $17.50, but with no business.

THE CHICAGO DISTRICT.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

The market has been dull and uneventful for the past week and sales have been smaller than in the week before, in almost every branch of the business. Yet there seems to be an expectation on the part of dealers in iron and steel that the volume of trade will be considerably larger within a short time, with prices firmer if not higher. Pig iron was very quiet last week and Southern furnaces secured the bulk of the business. In bar iron one good sized sale is reported but aside from this business was quiet. Orders for rails were fewer and aggregated a less tonnage than in the week before and the prospect for immediate orders is not so encouraging as it seemed two or three weeks ago. It is probable, however, that a fair tonnage will be placed by the railroads about the first of next month. Structural material was quiet and no large contracts were closed. General business appears to have fallen off to some extent. Prices on finished materials are firm, except that plates appear to be rather weak.

PIG IRON.—Only a moderate business was done by the local furnaces last week and inquiries are somewhat fewer. The furnaces expect a better business within the next few weeks and are also inclined to the belief that prices will improve. Southern furnaces secured a fair amount of business and report good inquiries which they expect to close up within a short time. Prices on both local and Southern irons are weak, as sales have been made at figures quite a little under the quotations we give. The large Southern producers claim to be holding to quotations and that the cut prices are made by smaller furnaces anxious for business. Lake Superior charcoal was quiet and no especially large sales were made. Quotations are as follows:

Lake Sup. Charcoal	$13 50@14 00	Southern No. 2 Soft	$11 60@11 85
Local Coke Fdy. No. 1	12 75@13 25	South'n Silveries No. 1	12 75@13 00
Local Coke Fdy. No. 2	12 25@12 75	South'n Silveries No. 2	12 15@12 75
Local Coke Fdy. No. 3	11 25@11 75	Jackson Co. Silveries	14 50@16 00
Local Scotch Fdy. No. 1	12 75@13 25	Ohio Silveries No. 1	15 00@15 50
Local Scotch Fdy. No. 2	12 25@12 75	Ohio Silveries No. 2	14 50@15 00
Local Scotch Fdy. No. 3	11 25@11 75	Ohio Strong Softeners	15 00@15 50
South'n Coke No. 1	12 50@12 85	Alabama Car Wheel	16 85@17 35
South'n Coke No. 2	11 85@12 10	Malleable Bessemer	13 75@14 00
South'n Coke No. 3	11 60@11 85	Coke Bessemer	13 75@14 00
Southern No. 1 Soft	11 85@12 10		

BARS.—One sale of 1,200 tons of steel bars at 1.30c was reported and several sales of iron bars at 1.35c, ranging from 200 to 300 tons. Rumors of cut prices continue and it is extremely probable that a price considerably better than the association quotations could be obtained by a buyer desiring a large lot of iron. Quotations are continued at 1.35c for common iron, 1.40c to 1.45c for guaranteed and 1.30c to 1.40c for soft steel bars from strictly billet stock.

RAILS AND TRACK SUPPLIES.—The local mills report only a small business closed last week and a decrease in inquiries. The expectation is that some of the Western roads will place considerable tonnage about the first of April. Quotations are unchanged as follows: Rails, $29 and up; splice bars, 1.65c to 1.75c; track bolts, 2.25c to 2.45c; spikes, 1.85c to 1.90c.

BILLETS AND RODS.—Sales of rods last week were confined to a few small lots and the quotation is unchanged at $27.50 to $28. Billets are very quiet and are quoted at $19.50 to $20.

STRUCTURAL MATERIAL.—One contract of about 300 tons of bridge plates was placed last week, but aside from this no business of any size was transacted. General business is quieter but the mills look for an increase in the small trade within the next few weeks. Quotations on everything but plates are firm and while those on plates are unchanged they are a trifle weak. Beams and channels, 1.70c to 1.75c; angles, 1.55c to 1.60c; plates, 1.60c to 1.65c; tees, 1.70c to 1.75c. Small lots from stock are quoted ¼c to ½c higher.

PLATES.—The demand has fallen off quite a little and only a few small sales were made last week. The local mills are well sold up and are not pushing for business, preferring to wait for better prices. Quotations are as follows: Tank steel, 1.60c to 1.65c; flange steel, 1.85c to 1.90c; fire-box steel 2.85c to 5c; boiler tubes, 60 to 65 per cent discount.

MERCHANT STEEL.—Dealers report a continuation of fair business and that they expect the demand for the next few weeks will be good. Prices are made as follows: Open-hearth spring, tire and machinery steel, 1.95c to 2.05c; smooth finished machinery steel, 1.70c to 1.75c; smooth finished tire 1.65c to 1.70c; tool steel, 5 50c to 7.50c; specials, 11c and upwards; Bessemer bars, 1.55c to 1.65c.

SHEETS.—Only a moderate business was transacted and demand appears to have decreased considerably. There is still a wide difference in the views of various mills as to quotations, which range from 80 per cent to 75 and 5 per cent discount for galvanized and 2.35c to 2.40c for No. 27 black.

OLD RAILS AND WHEELS.—The market is very quiet and while the demand for old wheels continues to be fair no large transactions were made last week. Quotations are made at $14 for old wheels, $10.50 to $11 for old steel rails and $14 for old iron rails

SCRAP.—The demand for scrap continues light and only a few small sales are reported. The following are buying quotations furnished by dealers: Railroad forge, $10.50 to $11; dealer's forge, $10; No. 1 mill, $6; railroad cast, gross ton, $9.50 to $10; machinery cast, $10 to $11; axles, $13; cast borings, $4; wrought turnings, $5; axle turnings, $5.75; mixed steel, $9; stove plates, $4; heavy melting steel, $10.50.

IN OTHER MARKETS.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

Pittsburg. The expectation that Bessemer ore prices will be announced at Cleveland within the next 10 days creates little interest in the market here. The belief that an advance of $1.10 a ton on Gogebic Bessemers, will be made from the opening price of 1895 is still general. No transactions of moment in Bessemer iron are reported since the sale of 10,000 tons last week at $11.40 at a Shenango valley furnace, the iron being taken by a local dealer to cover short sales. Steel works in the Wheeling district have been operated to but a fraction of their capacity in the last two months and with two of the new furnaces at Duquesne to go in in May there is not as hopeful an outlook for prices on Bessemer as might be wished. The current quotation is $12.25 to $12.50 on prompt delivery. Foundry iron is only bought in small lots, and the weakening of prices in the past two months limits buying to immediate wants. Forge iron is still fairly active. Some sales of Southern have been made in this market. Recent transactions range from $10.90 to $11.15. On steel $17.25 to $17.50 is the nominal range, but nothing is doing on which to base a market price. Wire and wire nails have shown something of the activity that belongs to the season, but this tonnage under present conditions makes little impression on the steel market. The outlook for structural material is still reported excellent, and a large amount of work is in the estimate stage. Bridge work is reported to be fair. On beams and channels the 1.45c quotation is well maintained. Tank plate has sold at 1.35c, though this has been shaded in a few instances. Demand for bars is light.

On steel from billet stock, 1.10c is done. Bar iron is nominally 1.25c in the Mahoning valley but this is cut $2 to $3. The plans of the Merchant Bar Iron Association seem to be in suspense. Absence of demand has evidently made any definite move unnecessary. Pipe mills are quite fully employed and there is an end of the extremely low discounts quoted a month ago. Some formal action on prices may be taken soon, in view of the better condition of this branch of the trade. Muck bar on account of pipe sales, has been in some demand. Sales of 3,000 tons are reported at $21. Sheets are dull. We quote No. 27 common iron at 2.20c and galvanized at 75.10 and 5 per cent discount. Iron skelp is somewhat higher. Grooved is sold at 1.25c to 1.30c and sheared at 1.42½c. Grooved steel is still 1.15c and sheared 1.27½c. Some slight increase is noted in sales of old material. No. 1 railroad wrought scrap is quoted $12.75 old iron rails $16 to $16.25, old steel rails $13 to $13 50. The coke question is one of no little importance to furnacemen. While it is well understood that the interest now so largely supplying the market has the matter of price in its own hands, the only large independent producer not being in position to sell to the general market, the question is whether the changed conditions in iron and steel will be regarded in fixing the price for April, and for the next two months of the second quarter. Independent furnacemen are represented as unwilling to pile iron on $2 coke, the policy of the Connellsville interest of making the price month by month, making the future too uncertain. The reports of operations in the Connellsville region in the past few weeks have shown a steady decrease in the output. In the week ending Feb. 29, with 12,274 ovens active production was estimated at 122,725 tons. Furnaces are taking only coke enough for absolute needs. Shipments were 6,329 cars, an increase of 333 over the preceding week. The number of active ovens has decreased nearly 25 per cent since the beginning of the year.

Cincinnati. There is quite a decided disposition manifested by small consumers to defer buying and the sales of the past week have been mostly in lots of 500 to 2,000 tons. Some of the larger consumers are taking advantage of the situation and are covering their wants from four to six month in advance. It is believed that production will be further reduced. Nothing is in view to encourage resumption by Northern furnaces. The increased cost of ore and coke seems to cut no figure in quotations on pig iron being made by producers who have it to sell. Rolling mills in Ohio do not report any activity in demand for finished products. Lake Superior charcoal pig iron has been prominent in this week's transactions, several round lots having been sold for delivery during the year. Prices obtained have evidently given the makers little above cost.

St. Louis. The demand for pig iron the past week has been very light. Several inquiries for small lots have given life to the market, but there is nothing like the heavy buying movement that was expected at this time. Business is dull and buyers are ordering their supplies with extreme caution.

Buffalo. There is an air of quietness about the local market which is hardly reflected to a like degree in tonnage. This is due to the inactivity of buyers in general and the large size of the few transactions which have taken place. Jobbing foundries appear to be increasing their melt and owing to a scarcity of good scrap considerable of the closer grained pig iron has been sold as a substitute. Prices remain unchanged. The range is $12.75 to $13 for No. 1 strong foundry iron; $12.25 to $12.50 for No. 2; $13.50 to $14 for Lake Superior charcoal; $13 to $13.50 for No. 1 Ohio strong softener, and $12.50 to $12.75 for Southern softener No. 1.

Charcoal Iron for Chain Cables

Makers of charcoal iron get some satisfaction out of the requirements for iron for chain cables as established at the last revision of the specifications of the Bureau of Equipment, Naval Department. The amended specifications are as follows:

1. All bars must be of homogeneous iron, and must not show more than one-tenth of one per cent of phosphorus, nor more than three-hundredths of one per cent of sulphur; the silicon and manganese must be low.

2. The bars must be in length a multiple of 20 inches, with one inch added to the length of the bar.

3. The bars must be free of fag ends.

4. These bars may be in cross section six inches by one inch, or two inches square, or one and one-third inches square, and must have a tensile strength of from 48,000 to 50,000 pounds per square inch; an elastic limit about 28,000 pounds; an elongation at least 30 per cent in a length of eight inches, and a contraction of area of at least 40 per cent.

5. Bolts cut from one per cent of the bars rolled from this iron at the Boston Navy Yard to sizes for cable making must stand bending cold until the sides are brought parallel, the distance between the sides not to exceed two diameters. Bolts similarly rolled must also stand bending at red heat until the sides are close together without any signs of fracture. The bolts nicked and broken cold by slow bending must show all fibrous.

6. One per cent of the bolts rolled from this iron at the Boston Navy Yard to chain sizes will be made into test specimens of three links, and this triplet must stand a pull of at least 158 per cent of the original strength of the bolt.

7. No bars showing evidence of cold rolling will be accepted.

8. Physical tests to be made at the Navy Yard, Boston, or or Watertown Arsenal, Mass., and all of the above material, before acceptance, to be subject to inspection, and the right to reject any or all of the same that does not, in the opinion of the inspector, fulfill all requirements.

9. The first car load of iron to be delivered at the Navy Yard, Boston, Mass., 20 days after date of contract; final delivery to be made within three months after date of contract.

Translucent Fabric for Shop Roofs.

"Translucent fabric" is a product recently brought out by the Translucent Fabric Co., of Boston, and designed to take the place of glass in skylights, shop roofs, train-sheds, and other positions where a light transmitting medium is desired. It has the advantages of glass, without the objections to the latter. It is a wire cloth of one-eighth to one-twelfth inch mesh, covered with a semi-transparent, impervious material.

The wire cloth is made from best steel and is very strong. The material which covers the wire cloth is a chemical solution, as durable as any elastic substance. It is not affected by heat, cold, rain, snow, hail or sleet. It is water and weather proof, flexible, will not break or crack, and is as translucent as skylight glass. It is a non conductor, making a building warmer in winter and cooler in summer, and being free from condensation. Its weight is from 1-7 to 1-10 that of glass. In price it compares favorably with glass. Heat will not affect it, 800 deg. F. having been applied without ignition. It has been in use, in a skylight inclined at an angle of 45 degrees, on a foundry within 20 feet of the chimney which would blow out hot sparks, bits of molten metal, etc., for an hour at a time, without damage to the material.

For the forge shop of the Berlin Iron Bridge Co., East Berlin, Conn., 5,000 square feet were ordered, the fabric being used on the roof of the monitor, running the entire length of the building. The Clinton Wire Cloth Co. and the Berlin Iron Bridge Co. note that it has withstood heavy storms without leakage, the former company having had it in use for four years.

ONE of the Cleveland Rolling Mill Co.'s two Central furnaces was put out of blast March 1. Its Newburg furnace is also out and new stoves are being put in.

THE IRON TRADE REVIEW

DEVOTED TO

IRON AND STEEL MANUFACTURE, FOUNDRY AND MACHINERY TRADES, IRON ORE PRODUCTION, TRANSPORTATION, AND GENERAL INDUSTRIAL PROGRESS.

PUBLISHED EVERY THURSDAY BY

THE IRON TRADE REVIEW CO.,

CLEVELAND, OHIO.

CLEVELAND:
37 VINCENT STREET.
A. I. FINDLEY, Editor.

CHICAGO:
1142 MONADNOCK BLOCK.
B. M. GARDNER, Associate Editor and Western Manager.

TERMS OF SUBSCRIPTION, (strictly in advance):

One year.....$3 00
Six months.....1 50
Three months.....75

Advertising Rates Furnished on Application.

The Cleveland News Co. will supply the trade with THE IRON TRADE REVIEW, through the regular channels of the American News Co.

ENTERED AT THE POST OFFICE IN CLEVELAND, O., AS SECOND CLASS MATTER

MARCH 12, 1896.

FURNACEMEN AND THE COST PROBLEM.

Blast furnacemen, particularly those whose product comes in competition with the foundry and forge irons of the South, are not a little interested in the prospects for the maintenance of the $2 price for Connellsville coke. Southern iron was able to hold its position in Eastern and Central Western markets, while Connellsville coke was selling at 90 cents at the oven, and Lake Superior foundry ores at from $1.75 to $2.50, the Chicago district being the only one in which there was any material displacement of the Southern product. This being so, what is the outlook for Northern foundry irons, if from 25 to 50 cents a ton above early 1895 prices is paid for ore, owing to higher lake freights and higher labor cost, and the $2 basis continues for Connellsville coke?

The increase in furnace, in coal and ore mining and in coking labor in the South, that came with the pig iron boom, last summer, was not so large as in the North; at valley furnaces the various advances between May and September added fully 40 per cent to the labor cost of a ton of iron. And the high wages reached, when Bessemer iron sold at $16.50 at the furnace, are being paid to-day, with sales in the valley at $5 a ton less. In foundry iron, the fluctuation in price has not been so great, to be sure; but the steady decline in the market, while from 65 to 85 cents a ton advance over fall prices is being paid for coke, has led to some serious thinking as to the possibility of maintaining profitable operation in the months just ahead. Southern furnaces owning their own coal and iron mines and their own coking plants, added to the readiness of their railroads to adjust themselves to market conditions, have advantages which they are likely to press to the utmost.

So far as furnace labor is concerned, it would seem that some action must soon be taken to bring this item of cost into a more equitable relation to the price of iron. As to the increased cost of non-Bessemer ore, competition among producers will prevent it from going beyond a price sufficient to cover higher lake freight and higher mine labor. A few particularly desirable foundry ores may bring their price, but the controlling influence, in the main, will be the more than ample production of ores of non-Bessemer grade. The coke situation is more uncertain. The control of so large a part of the Connellsville product being in the hands of one interest makes the decision of that single interest the law of the coke market. But it need not be assumed that this power will be arbitrarily used. Even though the $2 price can be enforced without any immediate loss of trade, the existence of forces whose operation might be accelerated, with the ultimate result of losing to the Connellsville field a share of its trade, is not likely to be ignored.

There is no doubt that $2 coke has been a stimulus to the interest taken by furnacemen in retort coke ovens. The incipient steps in the development of this industry in the United States have brought two or three propositions, heretofore disputed, to the point of demonstration. One of these is that Connellsville coal, coked in retort ovens, with the saving of hitherto wasted products of the process, makes as good a blast furnace coke as that from the bee-hive oven. Another is that other coals that have not made satisfactory coke in the bee hive oven can be coked successfully in the retort ovens. The certainty that vast deposits of coal heretofore not regarded as suitable for metallurgical fuel are to-day available for blast furnace use will naturally stimulate effort by furnacemen to reduce their coke bill. While the erection of an expensive plant of retort ovens might stagger the average independent furnace company, the big steel companies, as some of them are demonstrating, are willing to take up the problem. And in districts in which are concentrated a number of furnaces of average capacity, as in the Mahoning and Shenango valleys, there is some agitation of the proposition to make the erection of retort ovens a matter of joint undertaking.

Like other problems that seem hedged about with serious difficulties, these that now confront the furnacemen of the Central West are not likely to go long unsolved. And as that of coke cost has pinched harder than any other in the past two months it is natural that it should just now be the subject of closest inquiry.

THE conference between representatives of rolling mills west of the Alleghenies, and officers of the Amalgamated Association, held in the past week, and their canvass of the returns of January and February sales of bar iron resulted in a considerable reduction of wages in puddling and finishing mills. For the past two months puddlers have been receiving $4.50 a ton, based on an average of 1.30c for bar iron delivered in November and December. The rate established on the returns of January and February business is $4, indicating that the average price at mill in that time has been below 1.20c. Wages in finishing mills which were increased two per cent on Sept. 1, and two per cent Jan. 1, have likewise fallen back to the basis of last July and August. The sheet mill scale has been under adjustment in Pittsburg this week and the announcement is made that the minimum scale rate will continue. It is unfortunate, both for owners and workmen that the condition of the trade compels reductions, but if they result in any enlargement of the scale of operations, which has been exceedingly limited in January and February, the lower price will not be altogether an unmixed evil. It is interesting to note in this connection that the annual adjustment by the Midland Iron and Steel Wages Board has recently been made at Birmingham, Eng. Something

can be appreciated of the better remuneration of the puddler in this country, in spite of the reductions of the past few years, in the statement that the rate fixed for the coming year is 7s 3d, or about $1.75 a ton. Puddlers on the other side have had to accept a steadily decreasing wage in the past five years, following a reduction in the market price of bar iron, of about 30 per cent in that period. In the Western rolling mills of the United States, the reduction of puddlers' wages in the three years preceding the Amalgamated convention of last June was about 30 per cent, though in the same time the price of bar iron had fallen from 40 to 45 per cent. Not only has the pay of puddlers in this country been between two and two-and a-half times that in the Midland districts, but the ratio of decline has been less, on this side, as compared with the market prices of mill products.

Meeting of Soil Pipe Manufacturers.

A meeting of the Central-Western Soil Pipe Manufacturers' Association was held in Birmingham, Ala., in the last week of February. Among those present were Theo. Ahrens, Jr., general manager Ahrens & Ott Mfg. Co., Louisville, Ky.; A. Fowler, Jr., treasurer Rundle & Spence Mfg. Co., Milwaukee; John Clifford, manager L. Wolff Mfg. Co, Chicago; R. B. Humphries, president Humphries Mfg. Co., Mansfield, O.; R. G. Giesler, secretary Bell-Armstead Mfg. Co., Vincennes, Ind.; C. H. Kaevelage, Hoffman & Billings Mfg. Co., Milwaukee; W. H. Weller, Weller Pipe Co., Gadsden, Ala.; W. J. Lodge, Shuster Foundry Co., South Pittsburg, Tenn.; A. I. Dexter, president and F. H. West, vice-president, Alabama Pipe Co., Bessemer, Ala.; J. Early Lee, vice-president, and H. T. Biggs, manager, Birmingham Pipe Co., Birmingham, Ala.; W. H. Kettig, president of the Milner & Kettig Co., Birmingham, Ala.

The organization of the association was perfected and a scale of prices adopted for the Central-Western territory. The soil pipe manufacturers of the United States, through this and the Eastern association, are now perfectly organized, and are working in harmony with each other.

The election of officers resulted in the following executive committee being selected: Theodore Ahrens, Jr., chairman, A. Fowler, Jr., and John Clifford. After the business meeting the pipe manufacturers were banqueted by the Sloss Iron & Steel Co., represented by W. L. Sims, treasurer and D. L. Cobb, Chicago, sales agent. The Tennessee Coal, Iron & Railroad Co., through James Bowron, treasurer, gave the members of the association an excursion to the Howard-Harrison Pipe Works, the iron mines and several of the blast furnaces in the Birmingham district.

CORNELL UNIVERSITY, of Ithaca, N. Y., is declared the winner of the prize lathe offered by the Davis & Egan Machine Tool Co., of Cincinnati, to the technical or mechanical school in the United States receiving the most votes in its contest. The prize is the silver plated tool room lathe that attracted attention at the World's Fair in Chicago. Cornell has a total of 95,818 votes. The Jewish Manual Training School of Cleveland follows with a vote of 85,000 and the Cincinnati Technical School comes third with 68,060 votes. Among other schools interested in the contest were the Massachusetts School of Technology, Armour Institute, of Chicago; Stanford University, of Stanford, Cal.; Pratt Institute, of Brooklyn, N. Y., and the University of Michigan, and all of the schools of importance in the country. The total number of votes cast was over 1,000,000. The machine is now at the Chicago branch of the Davis & Egan Co., but will be shipped to Cincinnati and exhibited before being sent to Ithaca.

A TELEGRAM announces the death at Coronado Beach, Cal., March 11, of Henry Jarecki, founder of the Jarecki Mfg. Co., of Erie, Pa. He was a native of Posen, Prussia, and became a citizen of Erie in 1845.

THE annual meeting of the Johnson Co. will be held at Lorain, O., March 25.

STANDARD STRUCTURAL SHAPES.

The manufacturers of steel structural material have prepared for circulation among their trade, additional details of the standard shapes adopted at the Washington meeting of the Association of American Steel Manufacturers. The following appear in a special booklet just issued by the Carnegie Steel Co., Ltd.:

MINIMUM AND MAXIMUM WEIGHTS AND DIMENSIONS OF STANDARD I BEAMS.

Depth of beam in inches	Weight per Foot. Min.	Intermediate.	Max.	Flange width. Min.	Max.	Web thickness. Min.	Max	Increase of web and flanges for each lb. increase of weight.
24	80.00	Vary by 5 lbs.	100.00	7.00	7.25	.50	.75	.0123
20	64.00	65 lbs then vary by 5 lbs.	75.00	6.25	6.40	.50	.65	.015
15	42.00	45 " " " " " 5 "	55.00	5.50	5.75	.41	.66	.020
12	31.50		35.00	5.00	5.69	.35	.44	.025
10	25.00	Vary by 5 lbs.	40.00	4.66	5.10	.31	.73	.029
9	21.00	25 lbs then vary by 5 lbs.	35.00	4.33	4.77	.29	.73	.033
8	18.00	Vary by 2½ lbs.	25.50	4.00	4.27	.27	.54	.037
7	15.00	" " 2½ "	20.00	3.66	3.87	.25	.46	.042
6	12.25	" " 2½ "	17.25	3.33	3.57	.23	.47	.049
5	9.75	" " 2½ "	14.75	3.00	3.29	.21	.50	.059
4	7.50	" " 1 "	10.50	2.66	2.88	.19	.41	.074
3	5.50	" " 1 "	7.50	2.33	2.52	.17	.36	.098

MINIMUM AND MAXIMUM WEIGHTS AND DIMENSIONS OF SPECIAL I BEAMS.

20	80.00	Vary by 5 lbs.	100.00	7.00	7.28	.60	.88	.015
15	80.00	" " 5 "	100.00	6.40	6.77	.81	1.18	.020
15	60.00	" " 5 "	75.00	6.00	6.29	.59	.88	.020
12	40.00	" " 5 "	55.00	5.25	5.61	.46	.82	.025

MINIMUM AND MAXIMUM WEIGHTS AND DIMENSIONS OF STANDARD CHANNELS.

Depth of channel in inches.	Weight per Foot. Min.	Intermediate.	Max.	Flange width. Min.	Max.	Web thickness. Min.	Max.	Increase of web and flanges for each lb. increase of weight.
15	33.00	35 lbs. then vary by 5 lbs.	55.00	3.40	3.82	.40	.82	.020
12	20.50	25 " " " " 5 "	40.00	2.94	3.42	.28	.76	.025
10	15.00	Vary by 5 lbs.	35.00	2.60	3.18	.24	.82	.029
9	13.25	15 lbs. then vary by 5 lbs.	25.00	2.43	2.82	.23	.62	.033
8	11.25	Vary by 2½ lbs.	21.25	2.26	2.62	.22	.58	.037
7	9.75	" " 2½ "	19.75	2.09	2.51	.21	.63	.042
6	8.00	" " 2½ "	15.50	1.92	2.28	.20	.56	.049
5	6.50	" " 2½ "	11.50	1.75	2.04	.19	.48	.059
4	5.25	Vary by 1 lb.	7.25	1.58	1.73	.18	.33	.074
3	4.00	" " 1 "	6.00	1.41	1.60	.17	.36	.098

The Carnegie Co. announces that "any weights ordered other than those shown in the schedule will be charged for at the next higher weight given in the schedule." Beams and channels are cut to lengths with extreme variation not exceeding three-quarters of an inch. Any cutting to less variation will be charged one-tenth cent per pound extra.

The Walrand-Legenisel Process.

TO THE EDITOR OF THE IRON TRADE REVIEW:

I see in your issue of Feb. 27, under the head of "Baby Bessemer Practice," that Mr. H. L. Hollis says: "The investigation of the patent covering this process fails to show that anything similar has been done before, though in view of the calorific power of silicon and its well-known part in the Bessemer process, this may be considered surprising."

It is surprising to me that the attorneys who made the investigations did not discover some of my patents that described the calorific power of silicon when oxidized; and it is also surprising that they did not find "that anything similar had been done before." The Walrand-Legenisel process, as I understand its practice, is fully covered by my patents.

JACOB REESE.

Philadelphia, March 7.

THE strike of Cleveland boiler-makers, which started with the walking out of the Cleveland Shipbuilding Co.'s employes, has been adjusted. The men are given an advance of 12½ cents a day, instead of the 10 per cent asked for. They have been paid from $2.37½ to $2.62½ a day and will now get from $2.50 to $2.75.

RECEIVED FROM THE TRADE.

"Facts, Experience and Results on Wood and Metal Decoration and Preservation," is the title of a treatise on the characteristics of a good paint and the results that have been attained with the product of the National Paint Works, Williamsport, Pa. It starts out with a reference to the amount of literature from engineers and architects on the subject of paint for iron and steel protection, the inference being that the problem has not been solved to their entire satisfaction. Reference is made to the papers prepared for engineering societies by E. Gerber, M. P. Wood and Walter G. Berg, and the writer of the pamphlet follows with the judgment that the engineering mistake of the past in connection with the protection of iron and steel work has been the specifying of oil for the shop coat and not giving enough attention to having the surface absolutely clean, that receives the first coat of paint. The discussion is interestingly pursued in the pages of this pamphlet, and records and expert opinion are cited in support of the claims advanced for the Williamsport product.

The Gates Iron Works announces in a folder the removal of its city office, Chicago, to suite 1112 Masonic Temple. Mining and quarry papers are kept on file.

The Harrison Safety Boiler Works, Germantown Junction, Philadelphia, have recently issued a booklet on Cochrane heaters, which contains considerable valuable information relative to the utilization of exhaust steam, and discriptions of this heater, together with detail drawings and other illustrations. A. Sorge, Jr., M. E., 1533 Marquette Building, Chicago, is agent for the sale of Cochrane heaters, and will send one of the booklets on application.

"How to be Happy" is the title of a handy pamphlet that leads the reader from a pointed illustration of unhappiness up to the desirability of certain machinery manufactured by Foote, Barker & Co., Cleveland. The illustrations are miniatures of blue print tracings—white on blue. Walter L. Cheney, Meriden, Conn., is the author of the booklet, which is a unique bit of trade literature.

That a catalogue of 128 pages is required to illustrate and describe appropriately the products of a modern steel roofing establishment is proof of the rapid evolution of that industry. The 20th annual catalogue of the Canton Steel Roofing Co., of Canton, O., is of the generous proportions indicated, and while roofing and siding are still the staples of the trade the amount of space given to building-metal specialties shows how the inventiveness of manufacturers in these lines has extended the use of their products.

Joliet Rod and Wire Plant to Be Sold.

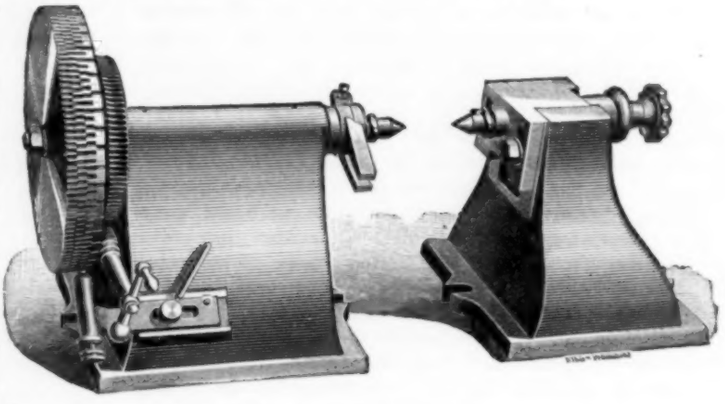
By order of the Circuit Court of Will County, Ill., Geo. H. Munroe, receiver of the Joliet Enterprise Co., of Joliet, Ill., will sell the plant of the company to the highest bidder on April 8. Sealed bids for the property will be received by the receiver up to 12 o'clock noon of April 8th and will be opened in the Circuit Court at 1:30 P. M. of the same day. A certified check for $5,000 payable to the order of the receiver must accompany each bid.

The property of the Joliet Enterprise Co. consists of 20 acres of land in Will County, Ill., and the buildings and improvements situated on it, together with the tools, machinery, appliances, boilers, engines, etc. The plant is modern and complete and had been operated only about 90 days. Its capacity is 200 tons of rods per day. There are 100 drawing blocks, 75 barb wire fence machines, eight bale tie machines, and 36 wire nail machines. The location is eligible, being just outside of the city limits of Joliet. Freight rates are the same as Chicago. The buildings are constructed of brick, on stone foundations, and the plant is connected with the Chicago, Rock Island & Pacific Railway. The property has nearly a mile of side tracks along the side of it and connected with it. The warehouse is 120x400 feet in size. The machine shop is large and thoroughly equipped with all modern machinery and appliances. The buildings are heated by steam and the mill is supplied throughout with fire pipes, hose and chemical engines and is lighted by electricity, an electric plant being on the premises. In addition to water supply from the Illinois & Michigan canal, which is directly south of the plant, there is on the property a large artesian well of good water for domestic and steam purposes. The mill has full privileges and protection under the patents of the Columbia Wire Co. The plant has been kept in good order during the time that it has been idle, and is now ready to start running at an hour's notice. Steam has been kept up in the plant all the time, watchmen employed and the machinery and tools kept in running order.

An inspection of the mill may be had and any further information obtained by application to George H. Munroe, Receiver, Joliet, Ill.

IMPROVED 13-INCH CENTERS.

The pair of centers illustrated herewith are made by the Davis & Egan Machine Tool Co. (formerly the Lodge & Davis Machine Tool Co.) of Cincinnati. They are designed for use on planers, milling machines and shapers. They are provided with an improved index consisting of five circular plates or discs, each 5-16 inch thick and 7¼ inches in diameter, which are accurately cut with 44, 52, 56, 90 and 96 notches respectively, giving a wide range of divisions. These plates are readily taken off and others substituted, with different numbers for special work. Being cut through like a gear they give a much stronger pin than a drilled index. The index in this instance, is revolved by means of a worm gear, readily disconnected by the loosening of one bolt, when not required. Tongues are inserted in the bottom of head and tail stocks, and are readily taken out and fitted to the machine without destroying the alignment. The spindles worm and screw are made of best steel.



Western Foundrymen's Association.

The next meeting of the Western Foundrymen's Association will take place at the Great Northern Hotel, Chicago, Wednesday, March 18, at 7:30 P. M. Members or others having questions relating to foundry practice they would like to have discussed, are asked to send them in writing to the Secretary.

The editing committee has prepared the following questions which will be taken up in the order named, at the future meetings of the Association, and written or oral contributions to the discussions are solicited:

Is it desirable to have a recognized apprenticeship system, and, if so, what is the best form?

Are foundries generally noticing an irregularity in the grading of foundry pig iron? If so, does this irregularity exist more generally in northern than in southern irons? Does it apply to both charcoal and coke irons, and in your opinion is any of the difficulty traceable to an extreme desire on the part of furnaces to supply their Bessemer pig iron trade at the expense of their foundry trade?

In your experience, what is the most efficient method of cleaning light castings?

What is the proper temperature at which to bake cores? What method do you use for determining this temperature?

What is the proper amount of air, and pressure of same, to metal iron in a cupola, and what are the effects of too little and too much air?

Is it economical to ventilate a foundry artificially? What has been your experience?

What is the best method of lighting a foundry of modern design?

AIR PUMP AND EJECTOR IN STEAM-HEATING.

BY G. W. SCOTT.

It may not be without interest to consider the relative efficiency and economy of the above appliances when operating in connection with a steam heating system. In the case of the air pump the object aimed at is to procure and maintain, in the returns from the heating coils or radiators, a state of partial vacuum; and by this means, aided in part by the use of a thermostatic valve, to afford an easy and natural exit for the entrained air and water necessarily associated with any system of steam heating. On the other hand, the use of the ejector in a steam-heating system is merely to draw off the air in the returns, leaving the water of condensation to fall back by gravity through the main steam supply pipe. Now a very little reflection will serve to show the thoughtful that whatever may be the special merits of the application of the ejector, that system as a whole is defective which allows the water of condensation to fall back through the incoming steam supply.

In considering the two cases referred to, it will simplify matters if we take the following data, although, of course, any other figures in common would apply equally well. Let us therefore suppose that the volume within the return pipes is equal to two cubic feet; and let us first deal with the air pump which we may suppose has an area of 36 square inches, and stroke of 12 inches, giving a volume of one-half of a cubic foot for each double stroke.

Now, if we assume that at the commencement of the operation the air in the returns is at the ordinary atmospheric pressure of 14.7 lbs. per square inch, then it can be demonstrated that at the end of the 15th double stroke the pressure within the pipes will have decreased to 5.1744 lbs. per square inch. And since the area of the pump is 36 inches, with stroke of 12 inches, then the work done in the air pump will be represented by $36\times4.7628\times2\times15=5143,824$ foot pounds. The 4.7628 being pounds per square inch of average vacuum load.

Turning now to the ejector, we may consider what is done in this case in the work of reducing two cubic feet of air at an initial pressure of one atmosphere, or 14.7 lbs. per square inch, to a final pressure, as in the case of the air pump, of 5.1744 lbs. per square inch. Clearly, the work done is due to the velocity of the steam and part of this motion being taken up by the air with which the steam comes in contact. And if we assume the steam to be of a total pressure of 75 lbs. per square inch, its highest possible velocity due to such pressure and its weight will be about 1700 feet per second, the corresponding velocity of air at the pressure of one atmosphere being about 1,300 feet per second. Now these are the respective velocities when flowing into a vacuum; but we shall be justified in using such figures, primarily because of their simple and uninvolved character, and also because of the fact that any reduction of these velocities simply involves questions of resistances. Furthermore, it is generally conceded that the efficiency of a jet is at the highest when allowed the maximum velocity. And we shall therefore suppose the initial velocity of the combined steam and air to be 1,300 feet per second, a velocity acquired from a certain weight of steam at 1,700 feet per second.

Taking the weight of a cubic foot of air at normal pressure to be .08 lbs., then the weight of two cubic feet will be .16 lbs., and, therefore, the corresponding weight of two cubic feet of air at 5.1744 lbs. per square inch will be .05632 lbs. In other words, to obtain this final pressure of 5.1744 lbs. per square inch it is necessary to remove .10368 lbs. of air from the original quantity. Now it is immaterial whether we remove this air particle by particle, or as a whole; the theoretical consideration is the same within close limits. But for our convenience we shall consider it drawn out as a whole. And the weight of steam required for this purpose will be found by the following equation where x = the weight required.

$$x\times1700=x\times1300+.10368\times1300,$$

which gives .33696 for the value of x and the weight of steam required.

Now the initial energy of this moving body of steam is found by the well-known expression $\frac{W.\ V^2}{Z\ \ G}$ which gives, in this case, 15121.34 foot-pounds. And recalling the conclusion that only 5143.824 foot-pounds were required for the air pump, and comparing these theoretical values, it may readily be seen that the ejector requires $15121.34\div5143.824=2.93$ times the quantity of steam required for the air pump.

It should not be overlooked that these values are quite apart from radiation, friction, and internal losses generally. But while the air pump has its friction load to be added to the useful load, and to this extent would require additional steam, it must not be lost sight of that the friction of the steam and air in the ejector and pipes is considerable in its relative magnitude. And it should be further noted that while the ejector discharges the air into the atmosphere, which is perfectly proper, it also discharges the accompanying steam laden with latent heat, in the same direction; and this last is highly improper, although under the very nature of the case unavoidable.

In the case of the vacuum pump operated in connection with the Warren-Webster system of exhaust steam heating, this loss does not occur. The exhaust steam is discharged into the heating main and there suffered to part with its latent heat in the service of which it is such a valuable factor.

We have seen that only 5143.824 foot-pounds of work were required for the operation of the air-pump, whereas 15121.34 foot-pounds were required for the ejector. Now, these foot-pounds can be converted into equivalent units of heat; and if we take 772 foot-pounds as the mechanical equivalent, we have 6.663 units of heat for the work of the air-pump, and 19.58 units of heat for the work of the ejector. But this is by no means the end of the matter, for we must consider the total heat units in the steam employed. And since we have supposed the use of steam at 75 lbs. total pressure per square inch a common pressure for pumps and ejectors, we shall find that one pound of such steam contains 1207.2 units of heat. Of course, not all of these units are utilized even by the vacuum pump system, but we may safely consider that all above 80° are used in connection therewith. And if we allow that temperature as a basis for considering the disposition of the heat units concerned in the ejector system, we shall have as the total heat in the .33696 lbs. of ejector steam, $1207.2-80\times.33696=379.821$ units of heat, including, of course, the 19.58 units of heat employed in useful work.

The relative economy, therefore, of these two systems, apart from the delusive appearance of the first cost of a pump compared with the first cost of an ejector, will be as 6.663 to 379.821 or, in other words, the ejector will use and misuse about 57 times the number of units of heat required for the air pump used as herein described. Now this is an important conclusion; for if the ejector system dissipates about 57 times the units of heat employed or necessary for the vacuum pump, it is strictly as if one should say the use of the ejector involves the consumption of 57 times the amount of coal necessary to operate a vacuum pump.

Clearly then, any consideration having in view economic and efficient results must go beyond the mere appearance and relative cost of installation of an air pump or an ejector. The systems themselves must be comprehended as well as the imperative necessity for a just appreciation of the units of heat stored up in steam of any kind—whether of high pressure or exhaust.

Ravenswood, Ill.

Personal.

B. F. Jones, of Jones & Laughlins, Pittsburg, has returned from a winter's stay in Florida.

L. C. Hanna, of M. A. Hanna & Co., Cleveland, has returned from a three months' stay abroad.

Ex-Secretary Wm. C. Whitney, who is largely interested in coal mining properties in Eastern Canada, was a recent visitor at Johnstown, Pa., to inspect the retort-oven coking plant installed for the Cambria Iron Co. by the Otto Coke & Chemical Co., of Pittsburg.

Major C. D. Rhodes has recently joined the sales department of the Illinois Steel Co. Major Rhodes has been for over 25 years in the iron business, at one time being the Cincinnati agent of Jones & Laughlins. He goes directly to the Illinois Steel Co. from Sharon, Pa., where for some time he had been connected with the Arethusa Iron Works and other concerns.

LAKE SUPERIOR IRON MINES.

There has been some selling of Lake Superior iron mining stocks of late, in Cleveland and elsewhere, and for prominent stocks the tendency is upward. A number of small holdings of Cleveland-Cliffs Iron Co. stock have been taken up in the past few weeks by large owners of this stock. Par is $100. While the quoted bid is $40, some has changed hands at $44 in the past 10 days. Republic Iron Co. stock ($25 par) has scored a phenomenal advance since the summer of 1895, when some of it sold as low as $6 a share. A small block has been bought in the past week at $20. Lake Superior Consolidated Iron Mines ($100 par) is little traded in, in Cleveland, but some Eastern buyers have been getting hold of what has been offered in the past three months. While $15 to $16 was current at the close of navigation in 1895, there have been recent sales at $21 and $22. Lake Superior Iron Co. ($25 par) is quoted $33 to $35; Chandler ($25 par) $42 to $44; Minnesota Iron Co. ($100 par), $70; Pittsburg & Lake Angeline ($25 par), $80 to $85.

Whether the changed outlook for iron has influenced the decision is not known, but it is reported on good authority that the Lake Superior Consolidated Iron Mines has given up its option on the Rouchleau-Ray property, 80 acres in section 17, 58-17, south of Virginia, Minn. The option was taken early in December and was for 90 days, the purchase price being $1,250,000. The announcement of the option had a buoyant effect on Mesabi properties that were on the market and this has been followed by a slight reaction.

The Lake Superior properties north and west of Hibbing, Minn., operated by the Lake Superior Consolidated Iron Mines, are preparing for an active season in 1896. Hoisting plants furnished by the Webster, Camp & Lane Machine Co. have been or are being installed at the Rust, Burt and Hull mines of the Lake Superior group. These three shafts will be able to hoist half a million tons the coming season.

The Minnesota Iron Co. has an option on a portion of the Rouchleau Iron Co.'s lands adjoining the Canton mine near Biwabik.

The Shores mine which adjoins the Iron Belt on the west is a very promising property. The fee is owned by E. D. Nelson and others of this city. The Shores Mining Co., composed principally of Ashland parties, holds a lease and is conducting the development work. The single shaft on the property is is now down 145 feet, 100 feet of which is in high grade ore. It is believed that all the lens so far opened up will average over 66 per cent iron. At a depth of 125 feet a crosscut was run north and south showing an ore vein 64 feet between the walls. There is a good plant of machinery at the mine, capable of hoisting 500 tons per day. The Wisconsin Central will extend its tracks to the mine as soon as spring opens up. —[Ironwood, Mich., News- Record.

The machine shops at the Chapin mine are at work on the bailers that are to be used in unwatering the Hamilton and Ludington mines.

Within the last few days the Michigan Land & Iron Co. has issued a lease of the Bessie mine property near Humboldt to parties heretofore interested in the Bessie as stockholders, upon a basis of royalty, that if generally adopted, would insure the active development of all mineral lands in the county held for lease. In addition to the payment of taxes, the document provides for the payment of a royalty of ten per cent of the value of the ore in the car at the mine.—[Negaunee Iron Herald.

The Zenith mine at Ely, Minn., is employing 70 men in exploration work, and no more ore is being raised than is necessary in this work.

The differences between the fee owners and the lessees of the Colby mine have been adjusted and operations resumed. A force of 175 men will be at work in the near future.

The property of the Dayton Coal & Iron., in Rhea County, Tenn., has been purchased by Peter Donaldson and Thomas N. Mackinnon, of Glasgow, Scotland. The property transferred embraces 5,000 acres of coal lands, two mines in operation, coke ovens and two blast furnaces of 150 tons capacity each at Dayton, estimated in value at $200,000. The sale is understood to be part of a scheme of re-organization of the company.

NEW PUBLICATIONS.

COKE: A Treatise on the Manufacture of Coke and the Saving of By-Products. By John Fulton, E. M. Scranton, Pa.: The Colliery Engineer Co. 342 pages. Price $4.

Admittedly the greatest authority on the production and uses of coke in all their technical aspects, Mr. Fulton is just the person to prepare this important work. Much fragmentary matter is extant on certain of the topics Mr. Fulton takes up, but there has been until now no complete and exhaustive treatise. Coming at a time when so much interest has been aroused in the metallurgical world, in the manufacture of blast furnace and foundry coke by the use of the retort oven, Mr. Fulton's book does the iron industry a great service in bringing together all the data available on this important problem. Some of the conclusions of the author appear in separated statements three of which we insert here:

"It has become evident in the manufacture of coke from the secondary qualities of coking coals, that from the nature of the requirements of quick and high oven heat, to secure the hardest bodied coke possible from such coal, the retort type of coke ovens will have to be used." * *

"Modern [retort] practice is rapidly trending to thin heating walls, with horizontal flues. This assures rapid work in coking, 20 to 24 hours, and consequently a much larger output from the investment in the oven." * *

"For the large class of 'dry' coals, this oven [Semet-Solvay] is admirably adapted to produce a very good metallurgical coke—as good as can be made from this dry coking coal. It may be submitted here, as a general principle, that first-class coke cannot be made from second-class coals."

Not only is the book full in technical detail, but it goes at length into a description of the coal fields of the United States, the location of plants for the manufacture of coke, and the early methods of coking. The physical properties of the three principal fuels used in metallurgical operations and the laboratory methods of determining the relative calorific values of metallurgical fuels occupy two chapters. Greater space than to any other question, however, is devoted to the various retort systems, their comparative advantages, costs, products, etc. The volume is plentifully illustrated and is well printed.

RATIOS OF SQUARES AND ODD SIZES OF TIN PLATES. By George E. Day, Chicago. Casey & Day, 445 The Rookery, Chicago, publishers. Price, $1.50.

A most valuable aid to manufacturers, jobbers or consumers of tin plate. It is a very convenient book, vest pocket size, 2¾x5½ inches, and contains 48 pages of rules and tables, giving the ratio to the base box of 2,500 odd sizes and all squares from 9x9 to 28⅞x28⅞, with variations of ⅛-inch. The ratios given cover fully 95 per cent of all sizes used. A simple process is also given by which the ratios of 2,500 more sizes can be computed from the tables in the book. The ratio book is strongly and handsomely bound in flexible leather, and is printed in large clear type on heavy book paper.

MACHINE SHOP ARITHMETIC. By Fred H. Colvin and Walter Lee Cheney. The Practical Publishing Co., East Orange, N. J. Price 50 cents.

Of pocket size, well bound in cloth, and containing 88 pages, this little volume presents in convenient form an explanation of the principles underlying the mathematical problems which come up in the work of practical men—superintendents, draughtsmen, designers, machinists. Decimals, square root, cube root, mensuration, and problems involved in screw cutting, drilling for taps, speed of pulleys and gears, milling cutters, drills and taps, grindstones and emery wheels, are treated in a practical way and some valuable short cuts are given. The book is prepared by men who understand the need they have aimed to supply, and we doubt not it will make its way rapidly.

JOURNAL OF THE WESTERN SOCIETY OF ENGINEERS. Published bimonthly by the society, at 1737 Monadnock Block, Chicago. Subscription, $2 per volume of six numbers.

The Western Society of Engineers recently withdrew from the Association of Engineering Societies. It has just issued No. 1, of Vol. I, of the *Journal of the Society*. It is a volume of 144 pages, with a valuable supplement, giving profiles of waterway from Chicago and Duluth to Quebec and New York.

THE fall meeting of the Iron and Steel Institute will be held at Bilbao, Spain, and the programme includes visits to the principal iron ore mines in that district.

CONVEYING BELTS AND THEIR USE.*

BY THOMAS ROBINS, JR., NEW YORK.

About six years ago the writer had occasion to visit a large magnetic iron ore concentrating plant, and then saw for the first time rubber belts being used for conveying purposes. These belts were from 20 to 30 inches in width, and some of them were as long as 500 feet between centers. When I spoke of the enormous amount of material they handled with a small expenditure of power, the superintendent assented, but at the same time complained that although he bought the best quality of belts, the abrasion of the ore wore them out very rapidly, causing continually very large bills and renewals.

On close examination several interesting points were discovered:

1. It was noticed that the thin layer of rubber which covered the belt resisted the abrasion much longer than did a corresponding thickness of the cotton duck which formed the body of the belt; in fact, the life of the cover represented about one-half the life of the belt, although forming less than one-fifth of the total thickness.

2. Each layer or ply of duck wore out more quickly than the one preceding it, showing that the fibers were cut more easily when under tension, and of course the tension on each fiber increased as the number of fibers bearing the tensile strain diminished.

3. The wear was greatest in a line along the center of the belt. Frequently this part would be so quickly destroyed as to cause the belt to split in two longitudinally, though at the same time the portion nearer the edges was almost as good as new.

Noticing these facts, it became obvious that the functions of the cotton duck should be solely to give the belt tensile strength, and that it ought to be so protected by some abrasion-resisting cover that it would not be injured by contact with the material conveyed. It is also evident that this protecting cover ought to be of extra thickness over the center of the belt, in order to stand the harder work forced upon that part. Being engaged then, as now, in rubber manufacture, it was a simple matter to make a belt with a heavy rubber cover on the carrying side and thicker in the center than at the edges. This reinforced cover renders the resistance to wear equal in all parts of the belt, and although being merely the anticipation of a patch, like the brass toe-cap on the school boy's shoe or the two-ply seat in his trousers, it was, like them, deemed patentable. The ideal conveying belt would be like the celebrated "one-hoss shay," which disintegrated so evenly and so completely when its work was done that there was nothing left to repair or regret.

Wishing to ascertain what particular compound of rubber would make the most durable carrying surface, I made a lot of small samples, each mixed differently, and exposed them to a very powerful sand blast, which in its effect approximated the conditions to which the compound would be subjected in actual use, but more convenient for a large number of tests, being much quicker. The result of the first series of experiments indicated what grades of gum and what adulterants had better be left out, and also showed something that was very gratifying, namely, that there were certain adulterants which could be used in sufficient quantities to bring the cost down to a reasonable figure. I then made a second set of samples, following in the mixture the formula used in the more successful ones of the first set, but each new one was an attempt to improve upon its prototype. Some of the samples, owing to more intelligent methods in mixing them, proved so durable that the sand blast test became too tedious, and a more severe and expeditious one was needed.

Having at last decided upon the proper compound for the carrying surface, I applied it to the belts, and I may say that every belt made since that time, which was in 1892, is in good order to-day. In many cases, too, the belts which they replaced had been completely destroyed in three months' time under exactly similar conditions.

There are four principal methods of supporting conveying belts:

First we will consider the oldest method, in which the belt lies flat upon a straight-faced, horizontal pulley. On account of the liability of the material to roll off the belt this form is only suitable under certain conditions. The belt cannot be heavily loaded, and the feed must be so regulated that an even amount may be delivered to the belt at all times. If the material is below ¼-inch in size the speed may be as high as 300 feet per minute. In carrying larger stuff on flat belts the speed must be lower; but the most necessary thing is to keep the belt very tight, that the material may not be jarred off in passing over the idler pulleys. This, of course, increases the strain on the bearings, and from that fact, together with their low efficiency compared with systems to be described later, we may consider flat running belts as being out of date.

The second method, Fig. 1, is somewhat like the first, but with the addition of skirt boards at the sides to increase the capacity of the conveyor. This method of rigging belt conveyors is in great vogue among brick makers and others who handle clay. It will be easily seen that the material must collect between the skirt boards and the belt, and that, as it hardens, it will cut a strip off each side. The common practice is to start with a wide belt, and move the skirt boards in as fast as these strips are cut off. When the width is so reduced as to render the conveyor totally useless wheelbarrows are called into play until a new belt can be procured, and the entire process recommenced. This method is so entirely bad that I refrain from further description. It is only fair to say, however, that the skirt boards fill one usefull purpose, as it is the practice of the men shoveling into the belt to rap their shovels against the boards in order to get rid of the sticky clay. A board for this purpose can be applied, however, to a much better form of conveyor, and in such a way that it cannot interfere with the belt. (See Fig. 4.)

The third method is a slight improvement upon the last, in that a trough is made by raising the sides of the belt instead of using boards as described above. The conical pulleys used for this purpose are shown in Fig. 2. This method has an obvious fault, owing to its bad design. As the diameter of the pulley at the outer point is twice that at center, the outer edge of the pulley goes twice as fast as the inner edge. This causes a slip which soon wears out the under surface of the belt. For belts not wider than 14 inches this form is not bad, for with small belts the weight on the pulleys is light, and the effect of the slipping is consequently less severe.

The fourth and best form of belt support is composed of three pulleys, one carrying the middle or bottom of the belt, and one on each side with its axis at an angle of 45 degrees. The shafts of all three pulleys are held in a pair of combination bearings which can be adjusted to different widths of belt. I never supply any other form of support for belts wider than 14 inches, and when I refer to troughed belts in this paper it is to be understood that the sides are raised by means of these angle pulleys, as shown in Fig. 3. There has been no mention hitherto of the means of supporting the empty part of the belt on its return. This is done by a single flat pulley, or with a pair of smaller pulleys with an interval between them, as shown in the lower part of Fig. 3.

It is sometimes possible to save money in constructing a long conveyor by combining the first and last methods of belt support referred to. If the belt were run flat the whole distance it would need to be so wide that the extra cost of the belt would be about equal to the money saved in using the cheaper flat form of pulley; but by placing a set of troughing pulleys between every fourth and fifth set of flat pulleys, or at such other interval as may be found advisable, the load is so centered on the belt at each of these points that it has no time to overflow before it is again centered between the next pair. In this way the use of a very wide belt is unnecessary, but the conditions are not always favorable to this plan. On very long conveyors it is often advisable to have about midway a pair of idlers, running on a vertical axis, or inclined inward, so as to make a right angle with the edge of the belt. These will serve to keep the belt straight on the pulleys if there is any tendency to run toward one side. (See Fig. 5.)

The large pulleys at the end of the belt should be slightly crowned on the face, and the pulleys should not be less than four inches wider than the belt. The driving pulley ought never to be less than 30 inches in diameter, and in the case of long wide belts 48 inches is advisable, as it allows the first return pulleys to be so placed as to give the belt a very large arc of contact on the driving pulley. (See Fig. 6). Whenever it

*Read at the Pittsburg meeting of the American Institute of Mining Engineers, February, 1896.

is possible it is better to have the driving pulley at the delivering end of the belt; but if it must be at the receiving end a triple set of pulleys connected by gears can be easily arranged which renders slipping impossible with the longest and heaviest loads. I believe that this scheme was first used by S. H. Edwards, superintendent of the Magnetic Iron Ore Co., at Benson Mines, N. Y. (See Fig. 7). The proper distance between the sets of idler pulleys is an important factor in the

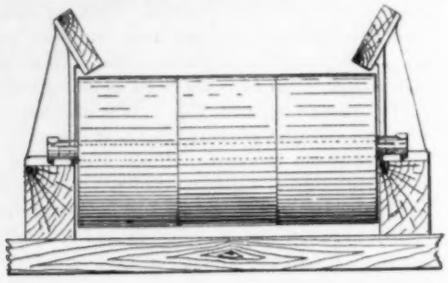


FIG. 1.—IDLER PULLEYS WITH SKIRT BOARDS.

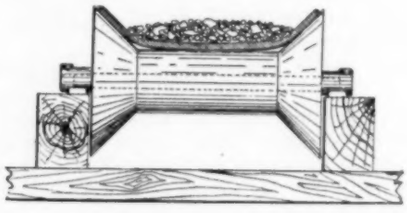


FIG. 2.—CONICAL SIDE IDLERS.

economical running of the belt, as will be referred to later. I believe that the troughing pulleys should be from four to six feet apart, according to the weight of the load, and that for the return belt there should be pulleys placed under every alternate set of troughing pulleys, which would make the lower pulleys from eight to 12 feet apart.

To me one of the most wonderful things in connection with

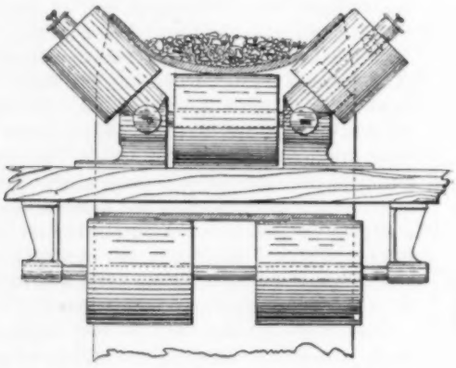


FIG. 3.—SUPPORT OF BELT BY THREE PULLEYS.

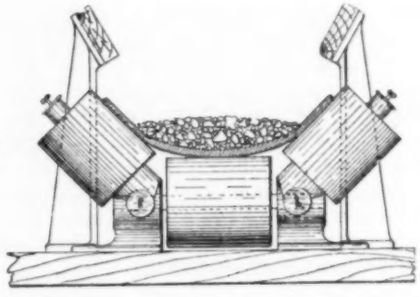


FIG. 4.—BELT SUPPORT AND SKIRT BOARDS.

this subject is the exceedingly small amount of power required to move enormous quantities of material. A conveyor which carries 1,000 tons per day a distance of 180 feet, and elevates it 40 feet while doing so, only requires four horse-power.

The widths of belting in most common use are 22, 24 and 26 inches, and the average speed is about 300 feet per minute. I am inclined to favor higher speeds, especially for elevating at

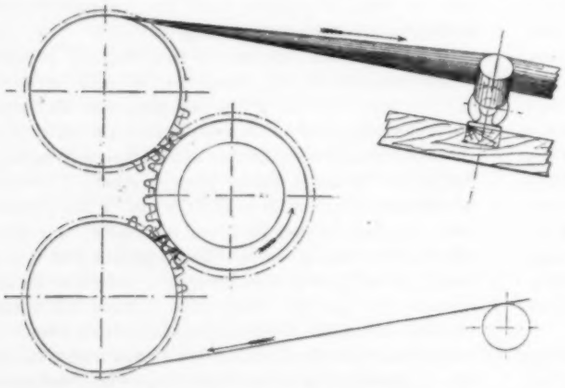


FIG. 7.—METHOD OF DRIVING LONG CONVEYORS FROM THE RECEIVING END.

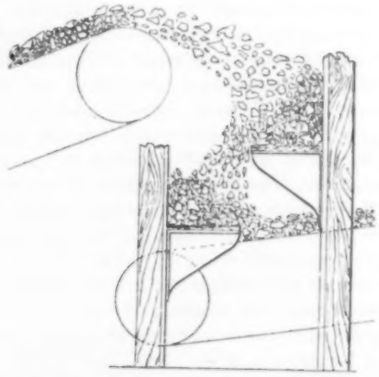


FIG. 8.—DELIVERY OF COARSE MATERIAL FROM ONE BELT TO ANOTHER.

an angle, as it requires less power to lift a small sized load at a high speed than the same amount of stuff per hour in a larger sized load at low speed. A good speed for level work is 450 feet per minute; at an angle, 650 feet is not at all too fast; and I have seen belts working smoothly at 900 feet per minute and at an angle of 27 degrees. Such speed as this, however, is hard on both the belt and idlers, and I do not recommend it. The following table shows the suitable number of plies for different widths of conveying belts:

Belts 20 inches wide and less should be 4 ply.
Belts 22 and 24 inches wide should be 5 ply.
Belts 26 and 28 inches wide should be 6 ply.
Belts 30 to 36 inches wide should be 8 ply.

The thickness of the rubber cover should be based upon the character of the stuff to be carried. For hard material weighing over 50 pounds per cubic foot the cover should not be less than ¼ inch in thickness. With the patent reinforced cover it is possible to have this thickness at the center where it is needed, allowing it to taper off to 1-16 inch or 1-8 inch at the sides where the work is lighter. This, of course, makes the cost lower than if the same thickness of cover extended the whole width of the belt. There is now an improved form of this belt which combines the advantages of this thickened cover with stiffened edges which give it such firmness at that part that a mere touch against the steering idlers serves to keep it running true. This stiffening is done by running two or three plies of duck a part of the way in from the edges, giving all the advantages of a heavier belt but at a lower cost.

At the point where a belt receives its load it gets as much wear as it meets with in all the rest of its journey. A few points should be borne in mind in connection with this part of the conveyor. The material should not be allowed to drop vertically upon the belt but should instead be so guided by an interposed chute as to strike the belt with as nearly as possible the same speed and of course in the same direction as that of the belt itself.

If ore or rock is carried there is bound to be wear wherever it touches. It is well, therefore, if it has to fall any distance, to let its force be broken by striking first against an accumulated pile of itself and then roll off on to a chute, whence it may slide quietly upon the belt and not move until it reaches

the end of its journey. See Fig. 8, which shows the device in use at the New Jersey & Pennsylvania Concentrating Works, Edison, N. J. The chute should be made of cast iron with sides, and should be so wide that the ore or other metal cannot get jammed, as it is very apt to do. The objection to a wooden chute is that the broken stone or ore does not slide properly upon it, but runs down in a succession of jumps that are as apt as not to carry it over the side of the chute or off the belt.

A device is shown in Fig. 9 for loading a belt under a crusher, from which falls both coarse and fine stuff. The line A represents a grizzly or screen of iron bars which allows nothing larger than one inch to go through. The small stuff slides down the chute B and forms a bed on the belt to

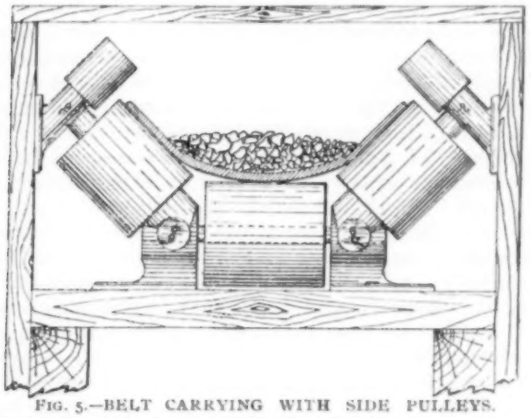


FIG. 5.—BELT CARRYING WITH SIDE PULLEYS.

protect it from the impact of the heavier pieces.

There are many ways of joining the ends of carrying belts, the most common being by the use of metal belt hooks consisting of a set of teeth cast together with a metal back. These have to be destroyed if the belt needs taking up. A better plan is thin steel plates upon a strip of thin leather or canvas which covers the opening in the belt and thus prevents leakage. Staples are driven through the holes in the plate and clinched. In breaking the joint the staples are easily cut with a cold chisel, but the plates themselves can be used an indefinite number of times. They are the invention of S. H. Edwards.

The simplest method of lubricating the bearings is by means of compression grease cups, which are dust proof and very economical. They are screwed into the ends of hollow shafts, and a man without stopping can give the handles a turn as he walks along the belt, and this only has to be done once a day at most. Grease costing about four cents a pound is generally used.

Some of the purposes for which conveying belts are used

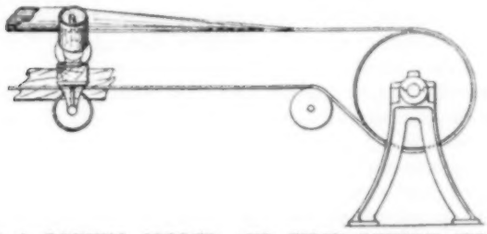


FIG. 6.—DRIVING PULLEY AND FIRST RETURN IDLER.

are the carrying of trap rock and limestone in stone crushing plants, charcoal and ashes in sugar refineries, ore in concentrating plants and mines, earth and stone in large excavations, blocks and logs of wood in pulp mills, clay in brickyards, coal in breakers, yards, large power plants and culm piles, tobacco in process of manufacture, customers' packages in large retail stores, grain in elevators and flour mills, boxed goods in coffee mills, phosphate ore and chemical fertilizer in plants all over the country. These are only a part of their uses, but the list of other purposes for which, though not employed, they are equally suited, and must some day be applied, would be a very much longer one.

Belts generally cost less to install than any link belt or other metal conveyor; and the cost of maintenance is so much less that there is simply no comparison between them. In addition to this they run noiselessly, instead of making a perpetual and deafening racket, and no owner's ears can become oblivious to a banging and crashing of which every vibration means wear and depreciation, as well as loss of power.

You may say, "If this belt method of conveying is all that this man claims, why haven't we heard more about it? Why isn't it used more widely?" My answer is this: The various systems of sprocket chain, metal pan, trough and screw conveyors and the overhead cable systems have all been owned by manufacturing concerns who make them known by advertising, undertake their construction and installation, and guarantee them. As to conveying belts, no fundamental patent on the principle could be secured; and because a belt conveyor is composed of two parts which are about equal in value and the products of entirely separate kinds of manufacture (I refer to, first, the iron pulleys and other supporting parts and second to the belt itself), no iron man felt like pushing the sale of a conveyor when he knew that some rubber manufacturer would share equally in the profits, and the rubber man would doubtless have felt the same, if, with his less extensive knowledge of machinery, the thought occurred to him at all. And so, between them, the belt conveyor has been neglected except where its merit compelled the recognition of a few wide-awake and self-reliant engineers. It has been the property of no one. Nobody's living depended upon its exploitation. It was to the interest of no one to stand sponsor for it; to develop, push it and perfect it. There are no data published about it, and each man who uses it to-day is practically the inventor of his own apparatus, which he has brought to its present state only after an expensive and vexatious experience. If an engineer to-day has a conveying problem to solve and the thought of a belt occurs to him, immediately afterward come the questions: What kind of a belt? What width? How should it be run? On what? At what speed? Where can I find out? Being unable to answer

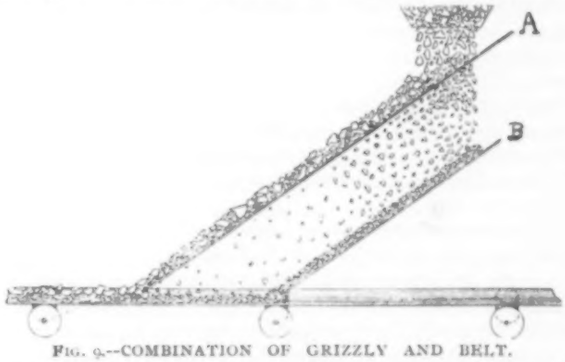


FIG. 9.—COMBINATION OF GRIZZLY AND BELT.

any of these questions, and not caring to try experiments, his natural inclination is to state his needs to the well-known manufacturers of conveying apparatus and make a contract with one of them thereby shifting the responsibility as soon as possible. The load of responsibility is apparently charged for along with the apparatus, but even the high price of the latter contains no suggestion of the great and continual expense incurred in running and keeping it in order.

I do not wish to appear as condemning universally the use of all metal conveyors, for there are indeed some conditions for which they are better suited than are belt conveyors. I may mention, for instance, places where the point of delivery must be constantly and quickly changed. With iron conveyors this is accomplished by the removal of a section of the iron trough, while a belt requires a movable frame work containing two pulleys. This dumping apparatus can be moved to any point in the belt's length, but it is neither as cheap nor as quick as the plan adopted with metal conveyors. Nor do I condemn the great ingenuity which has made possible even the poor performance of duties for which by their very nature they are absolutely unfitted. That is business. I only want to show that there are many places where other conveyors are now used for which belts could be substituted with economy.

The other day a man pointed to what he called a "real conveyor," which was dragging and scraping its load along (and apparently protesting against its own design and unfitness for the task) and observed: "Oh, this does the work cheap enough." It may be cheap, compared with manual labor; but it seems to me that with the competition of the present day nothing is cheap enough if there is anything cheaper.

FOUNDRYMEN'S ASSOCIATION.

The regular monthly meeting of the Foundrymen's Association was held at the Manufacturers' Club, Philadelphia, on Wednesday evening, March 4. President Schumann occupied the chair.

Secretary Evans read the report of the executive committee which noted that there was very little improvement in business. Continuing the report said:

"There is not the healthy feeling existing that we had expected for the new year. We find people are buying from hand to mouth rather than put in a stock of material to last several months. While there are a number of foundries that are quite busy, the majority of them seem to want work to fill up their shops. With the mild weather that must come, we hope there will be a decided improvement that the first half of the year will be a good average showing.

"The above report is rather discouraging but when compared with last year at this time we think there is considerably more activity and demand.

"We want to call special attention to the National Convention of Foundrymen to be held in Philadelphia, May 12, 13 and 14. The object of this meeting is to bring the foundrymen of the country together to discuss their interests and to urge foundrymen to form associations similar to ours in every section, to bring about a more friendly feeling than there is at present existing. We believe in the end this must tend toward more satisfactory prices and a better knowledge of the cost of producing castings. Foundrymen of Continental Europe have been organized for a number of years, and as a consequence, there is to-day a better price existing for castings in England, France and Germany, although the wages for molders are lower than in the United States. We are told of a small foundry in Scotland, employing 20 molders, whose profits for one year were $15,000. We do not know of a foundry of the same size in this country that can make as good a showing.

"While this Association does not take up the matter of price, nor does it expect to make the price at which castings shall be sold, we think by frequent meetings the foundries in different sections can get a more satisfactory figure than they are getting to-day.

"At the National Convention a number of important papers will be presented on subjects of National importance and as this will be the first convention of foundrymen ever held in the United States, we think it cannot fail to bring about good results. We would like the assistance of every foundryman in the country to help us make the National convention a success."

The report was accepted, and Secretary Evans then cast a single ballot electing to membership the Columbia Foundry Co., Kavanagh & McDermott, Pettinos Brothers, and the Philadelphia Sash Weight Works, all of Philadelphia.

F. C. Brooksbank read a paper on the "Sand Blast," which is printed in full on other pages.

President Schumann corroborated all that Mr. Brooksbank said of the merits of the sand-blast. Mr. Outerbridge did the same, and added that from experience he had found that castings were invariably weakened about 10% by pickling.

The meeting concluded with an address on the money question by Philip H. Bentz, who strongly favored a gold standard.

A Three Years' Record of Coal Consumption.

The following record of coal consumption for two Reynolds vertical boilers and an Allis cross compound engine, 22″x40″ x48″ is interesting because it covers a period of three full years. It will be appreciated that the average of a year's service represents something radically different from the short tests, covering a few hours or a few days, which are frequently published. The figures below are the result of operations at the Stevens Linen Works, Webster, Mass.:

	1893.	1894.	1895.
Average i. h. p. for year	381	393	396
H. p. hours for year	1,042,221	893,792	1,076,134
Engine coal	1,841,700 lbs.	1,493,243 lbs.	1,775,720 lbs.
Average coal per i. h. p. per hour for one year	1.76 lbs.	1.67 lbs.	1.65 lbs.

The engine was indicated forenoon and afternoon and the average taken for the daily record. The boilers were used exclusively for the engine, and the figures for coal include all-night banking.

SAND-BLAST FOR CLEANING METALS.*

BY F. C. BROOKSBANK.

The invention of the sand-blast process by Gen. B. C. Tilghman, of Philadelphia, in the year 1870, marked the introduction of an entirely new process into the arts. In the 25 years that have elapsed since that time the process has been in constant use for an increasing number of purposes, and seems destined to retain a permanent place of its own in manufacturing operations. During this time many persons have, of course, become familiar with the methods of its application, but there still remains in the popular mind a large degree of misconception of both the uses and limitations of the process. Also on account of its not having been able to fulfill the extravagant and often absurd ideas which were formed of its powers upon its first introduction to the public many people still think it an obsolete and abandoned process.

The process, stated shortly, consists of a stream of sand or other abrasive powder, usually dry, but sometimes mixed with water, projected with more or less force and velocity to strike and pulverize the surfaces of glass, stone, metal and other materials upon which it is directed.

It has been frequently pointed out that in this invention Mr. Tilghman has really borrowed from Nature herself, inasmuch as he has intensified and put to use a natural force, of which the effects are always apparent under favoring conditions; that is to say wherever we find large deposits of loose sand exposed to prevalent winds, by which the sand is caught up and blown against any hard substance, such, for example, as the glass in a window, which soon becomes depolished and obscured by the contact of the sand, or stone, the surface of which, with time, is sensibly roughened and sometimes scored in a manner quite distinct from ordinary weathering.

The abrasives used in the process include ordinary inland silicious sand, sharp builders' sand, powdered glass, emery, from fine to coarse, chilled iron-sand and steel shot; and the stream of the powders is forcibly projected through variously formed nozzles by means of steam, by currents induced by exhaust air, by blasts of air, and latterly, and more conveniently, by compressed air. Sand, from its plenteousness and general suitability, is mostly employed. The white beach sand of Jersey is probably as good as can be found anywhere for general purposes.

Action of the Sand Explained.

The action of the sand blast is not cutting, not grinding, not abrading in any of the usual meanings of these terms, but a true pulverization to which it is applied by the successive impact of the grains of flying sand. The sand acts much in the same manner, but on an infinitely reduced scale, as artillery projectiles in breaching a masonry wall, each independently of all the rest and the collective action of the blast, but a multiplication of the actions of each grain. In this action it differs from anything that has preceded it, and it is this difference between its action and all other processes that has caused the general misunderstanding about it above referred to. As all know the process consists simply in driving a stream of rapidly moving sand against the object to be operated upon. How the sand is given velocity or how the work is presented to the blast, are matters of indifference in examining the theory of the process. As the total action of the blast is but the summation of the action of the individual grains, the action of the individual grain is to be considered. If the single grain of flying sand has no effect when it strikes the work, then no other grains will have any, and the sand blast will be without effect, no matter how long continued. If, however, the single grain of sand has any effect upon the object struck, then the blast will wear it away, often at an extraordinary speed, as the number of grains propelled against it is very large, often as many as 5,000,000 per minute.

Grains of sand have numerous angles, and the action of these grains, as also that of the other abrasive mentioned, upon the surfaces of glass, stone or metal, is due to the circumstance that every individual grain, in the infinite number in the stream, urged violently forward, has all its energy instantly arrested, transferred and concentrated upon its point of impact, where it produces a minute pit or de-

*Read before the Foundrymen's Association at Philadelphia, Pa., March 4, 1896.

pression; and, as every grain in the shower acts alike, the abrasion resulting from the whole is perfectly uniform in depth and texture, or roughness.

The single question, therefore, to be considered is, does the stress at the point of impact between the grain of flying sand and the object struck rise high enough to overcome the strength of the latter.

[The speaker, in answering this question, showed that in the case of granite, which withstands a quiet crushing strain of 1,200 tons per square foot, the stress developed at the point of impact is decidedly in favor of the grain of sand.]

Considering the effect of the sand blast striking a piece of wrought iron, in place of the granite, it will be seen that the pressure developed upon the area of the first contact is as great as in the case of the granite, and the iron is equally unable to stand it, but instead of being pulverized like the granite, it is only indented and the indentation deepens as the grain progresses, until the same point is reached, namely, that at which the pressure per square inch over the area of contact is less than will continue to penetrate the iron. The result is no metal removed, but a small indentation produced. Othe grains striking in the immediate vicinity of this indentation simply shove the metal back into it again and obliterate the effect of the first grain. Thus no effect is produced, but the surface is simply roughened by the indentations of the sand grains. This is the normal effect of the blast upon all metals. If they are exposed for a long time to the action of the sand as in a sand blast, machine metals do wear away by the surface metal getting exhausted by the constant bending so that it at last breaks in place of bending any more to the blows. So important is this adaptation of the size of sand to the work that if two exactly similar machines are taken, one using fine and the other coarse sand and both using the same pressure of either air or steam to drive the sand and the same sized jet, the machine using fine sand will obscure three times the work that the machine using coarse sand will do. But in cutting or perforating glass or stone the machine using coarse sand will do three times the work of the machine using fine sand. In one case the blows are too few to break up much surface and in the other case they are too light to do much cutting. Thus by use of sand unsuited to the work the efficiency of a good machine can be reduced over 60 per cent.

Original Sand-Blast Apparatus.

The earliest forms of apparatus perfected was the high-pressure steam jet described in the patent of 1870. In this form of apparatus a small jet of high-pressure steam of an annular shape escapes into a larger tube and draws along with it a current of air through a central tube, which is surrounded by the annular steam jet. This inspirated current of air carries with it a large portion of sand and becomes mixed with the escaping steam and is thrown directly against the work at a high velocity. The nozzle tube is made of hard white iron and so constructed as to be cheaply and easily replaceable. This form of jet for hard, heavy cutting is as efficient in output of work in proportion to power used as anything that has ever been constructed since. Its other disadvantages, however, have caused it to be abandoned in favor of other devices of more modern construction. Among these were chiefly the wetting of the sand each time it was used; clogging of the sand feed pipe if this drying was imperfectly done; enveloping the work in a cloud of steam so that the progress of the work could not be followed by the operator; cracking glass articles by the sudden and unequal application of heat to them and rusting all articles of iron or steel, subsequent to the cleaning by wetting them with hot water from the condensed steam. The use of compressed air avoids all these disadvantageous qualities. In spite of all these disadvantages, however, this system was used for a long time to a considerable extent in the stone trade, among other things doing the marking of over 100,000 tombstones in the national cemeteries, cutting down the whole face of the stone and leaving the inscription in raised letters about a quarter of an inch high.

For cleaning metals, however, these disadvantages have totally prevented the use of the steam jet. Compressed air was tried in the same form of jet and did not succeed practically or commercially, although it did good work, on account of the great expense of providing a sufficient supply of compressed air at the pressures required and the small amount of work that a jet of compressed air used in one of these old induction feed steam jets would do was remarkable and most discouraging in comparison with what a jet of steam under the same pressure would do. And the whole class of induction feed jets would not work reliably at the lower and more economical air pressures. They, however, would work well, cost not considered, and completely obviated the faults just referred to of the steam jet.

In a recently designed machine these points have been retained, together with the full efficiency of the blast, due to the pressure at which it is used, unreduced by the admixture of any dead air carrying the sand with it, at just the place where the maximum velocity is desired. This machine uses air at all pressures, but those about 10 pounds to the square inch are found to be the most satisfactory. By immersing the whole sand supply in an atmosphere of air at the above pressure, contained in a tight reservoir, the advantages of a purely gravity feed are obtained, uncomplicated by any questions of difference of pressure inside of the jet tubes and without. Then, by the use of a flexible tube of considerable diameter, the sand and air, in a mixed current, are carried to a point where they are to be used. Here the flexible tube is terminated by a hard chilled iron cone, terminating in a tube of small diameter. In traversing this latter portion of its course the mixed current of sand and air increases its velocity inversely as the square of the diameter of the tube, and is finally discharged from the end of the blast nozzle at the full velocity due to the pressure behind it. An air-lock arrangement for transferring new supplies of sand into the sand reservoir, while still under pressure, and valves for operating and graduating the air and sand supply, with a suitable compressor for furnishing the supply of compressed air, complete the arrangement. This machine is comparatively new in this country, but has been used to a considerable extent in England and the Continent for cleaning off scale from sheet metal castings and forgings. The machines are built in different sizes, and, of course, their output of work depends strictly upon the amount of compressed air that they use per minute. Take the case of a machine using 60 cubic feet of air per minute. This requires three indicated horse power to run the compressor, which furnishes this amount of air compressed to a pressure of 10 pounds to the square inch. At this volume and pressure the work accomplished on ordinary rolled steel plates is one square foot per minute of scale removed.

Iron plate usually has thicker scale and requires slightly longer time. And forgings and castings differ so much in the nature of their scale, both from kind and heat of iron, kind of molding sand and several other particulars which differ in each case, so that it is impossible to give any general rate which will be sure to suit more than the individual case which is considered. Trial is the only safe criterion.

The Mathewson Improvements.

The recent improvements and inventions of Mr. Mathewson, manager of the Tilghman Sand Blast Co., Sheffield, Eng., has given a new impetus to the use of sand blast for a great variety of purposes.

In metal, for the removal of the hard scale, so destructive to cutting tools, from castings and forgings. The removal of the scale from sheet iron and steel prior to enameling, galvanizing, nickeling, tinning, etc; the cleaning of tubes and brazed joints, largely used in bicycle work; sharpening the teeth of files; for granulating or frosting electro-plate, gilding metal, gold and silversmiths' work, and jewelry; and the reduction of clean metal surfaces of larger works, ranging from steel forgings of safes to armor plates.

On stone, slate and granite, for incised carving and inscriptions in intaglio, or relief; for cleaning off the grime from stone, granite and brick buildings, and, in contrast to this last, for the most delicate drawing for lithography.

Among other purposes it is employed for removing fur and deposits in tubes and tanks; for cleaning off accumulations of paint and dirt within iron ships; for roughening the surfaces of metal rollers; for decorating coat or other buttons; for granulating glass to give it a key for ornamental painting by hand; for piercing the apertures in glass ventilators; for marking cakes of glue and cement; for marking pottery and in the manufacture of ornamental tiles; for smooth-facing bricks to receive white glass or enamel; for refacing grind-

stones, emery and corundum wheels; for granulating celluloid films for photography, and on wood, to bring out the grain in relief, and latterly, for blocks for printing.

Another recent improvement in connection with the use of sand blast is the application of it in connection with tumbling barrels. These barrels run very slowly (two or three revolutions per minute), consequently there is little risk of breaking fragile castings; neither are the edges of them worn off and destroyed, as in the case of ordinary rattling at high speed. The castings are not cleaned by tumbling, but by sand blast inserted at one or both ends of the barrel. The usual time consumed in cleaning a charge of this barrel is from 20 to 30 minutes. The latest design of this machine is arranged at an elevation directly over the sand blast apparatus, which has two flexible tubes and nozzles, which are inserted into each end of the barrel, which is inclosed and provided with an exhaust fan, which carries off the dust.

The barrel is perforated with small holes, through which the sand falls through a hopper and directly back into the sand blast apparatus, thus making it almost entirely automatic.

Preparation of Metals for Painting.

There is another application of sand-blast which is just beginning to attract the attention that it deserves. This is in the preparation of metal work of all kinds for painting as a protection against corrosion of all kinds, principally, of course, in protecting iron work against the weather. For this purpose the one necessary condition is to get a close contact between the metallic iron and the oil of the paint. If this is secured the paint will last and stick on in a manner entirely unknown in the present ordinary commercial painting of iron structures. If this absolute contact of paint and metal is not secured and the thinnest coat of oxide, either rust or scale intervenes, the painting is to a great measure useless. The paint not reaching the iron cannot stick to it, it can only stick to the coat of oxide which it can reach, and as a result when the coat of oxide loses its hold on the iron and drops the paint comes with it. It may be said that the paint will protect the coat of oxide and prevent its thickening and scaling off, but this is not the case, for rust once formed has a much greater tendency to go on growing than clean iron has to rust, and also the existence of this coat of oxide under the paint is the means of the absorption of water and air for long distances under the unbroken paint, around every break in the coating, where, if it did not exist, there would be no means of the injury of a small break in the continuity of the coating of paint extending beyond the actual surface of bare iron exposed.

The existence of these small accidental breaks in the surface of painted iron is much less apt to occur when the iron has been sand blasted than without this treatment, for the sand blast surface is particularly well adapted to give the paint just that mechanical hold upon the metal in each one of its innumerable indentations which it needs for a firm adherence. As an illustration of the perfection of the hold which a coat of paint has upon a sand blast surface, tin which has been sand blasted and printed with designs, etc., in the flat sheet, can be cut up with dies and struck up into boxes and similar forms without starting the paint.

The difference between what can and what should be done in the way of protection of iron by paint and what usually is shown in the case of ship plates, when, as is sometimes found, the numbers and marks painted on the plates in the rolling mill when the sheets are perfectly clean, just from the rolls, are found of the full original thickness of the plates, while the rest, painted in the ordinary way, is so much corroded as to render it necessary to replace the plate. This degree of protection is what should always be obtained if iron work is thoroughly cleaned by sand blast immediately before it is painted. And we will venture to predict that it will not be a long time before the specifications of structural iron work to be protected by paint will usually call for a thorough sand blast cleaning immediately before painting. Another use for which we predict a large demand for sand blast work is in boiler making. At present the sheets covered with oxide are placed together and riveted up. The blows of the riveting thoroughly pulverize the scale on the plates where they lap around each rivet, leaving a thin layer of powdered scale between the plates through the interstices of which steam and water under pressure will find their way, and to prevent this excessive caulking, now used, is necessary. Whereas, were the sheets clean metal to metal, without foreign substance between them at the joint, much of the present caulking would be unnecessary, which would leave the full strength of the rivets and plates to withstand the internal pressure instead of, as at present, a large portion of their strain being taken up in withstanding the initial strains produced by caulking, leaving only the remainder to withstand the internal pressure.

The ordinary method of attempting to produce a clean metallic surface on castings, forgings, etc., for these and other purposes is by pickling. And this process, apart from its numerous well known disadvantages, which need not be referred to here at length, but which make all who have anything to do with it wish to replace it with some other process, has a serious effect upon the internal structure of the iron, as the following reports of experimental results will show:

The Effect of Pickling Iron and Steel.

The effect of pickling and rusting on the strength of iron and steel has been shown by A. Ledebur, of Berlin. Rails, joists and bars were subjected to various conditions: (1) In the condition as delivered. (2) After exposure for purpose of rusting. (3) Galvanized and tested at once. (4) Galvanized and exposed for a time. (5) Pickled in acid and immediately tested. (6) Pickled and kept for a time in a dry place. The pickling was done with sulphuric acid diluted with water in the proportion of $\frac{1}{100}$. The samples were tested for transverse, tensile and compressive strains and under a falling weight, these experiments being made on the same sample for each of the six conditions. The bending tests with wrought iron joists showed substantially the same for all the conditions; the maximum loads carried showed differences, being highest in the natural condition and lowest when freshly pickled. Rusting also produces a diminution of strength more apparent in the galvanized than in those not galvanized. In the instances where the specimens were broken the diminution in strength is said to be very decided in the pickled and perceptible in the rusted specimens. The figures are: Breaking strain under condition 1, 35 tons; under condition 2, 33.9 tons; under condition 4, 32.7 tons; under condition 5, 29.6 tons, and under condition 6, 30 tons. The steel specimens showed results which follow the same law.

When iron is placed in acid, some of it is dissolved and hydrogen liberated. This gas is supposed to be of the nature of a metal, and as such it combines with and forms an alloy with the iron, which becomes quite brittle till the iron is heated and the hydrogen liberated, when it regains its tenacity. If a piece of wire be broken when it has thus become alloyed with hydrogen, and the end wetted, the bubbles of gas may be seen passing rapidly through the water. This condition of things was observed and investigated by Mr. W. Johnson, B. S., of Manchester, and afterwards by Prof. Osborne Reynolds, F. R. S. The latter showed that if an iron tube be closed at one end and filled with oil and placed in an acid solution, hydrogen is liberated from the outside, which passes through the wall of the tube, displacing the oil, so that the gas may be thus easily collected from the inside of the tube. There is a possibility, therefore, that when iron is rusting, the hydrogen liberated may similarly combine with the iron and render it brittle or reduce its strength, and this is a question of much importance to engineers.

Pickling Decreases Strength.

Some interesting experiments in regard to the decrease in the strength of iron after being pickled and galvanized were recently reported in *Tin and Terne*. A dozen eye-bolts, all precisely alike so far as could be perceived by external inspection, were carefully selected. Six of these eye-bolts were laid to one side, and the others sent away to be galvanized. A testing machine was not at hand, but six bolts were connected together, one being connected to each of the ungalvanized ones. Then they were placed between two pieces of iron and the nuts screwed up until the eye-bolts broke. Invariably it was found that the galvanized eye-bolts were the ones to break; not in any instance did the ungalvanized ones give way. Boat builders also state that galvanized iron is "rotten." They say that when great strength is required, select the iron and have the fittings forged by a good smith, but do not have them galvanized. Galvanized iron is frequently used in places

where little strength is required, but where rust would be objectionable. For this purpose galvanized iron leaves nothing to be desired, but where the full strength of the material is required and rust stains are objectionable, the object may be obtained by cleaning them with the sand-blast process and afterward coating them by the cold galvanizing process, both of which methods are becoming well known and largely used for the above purposes.

Sand-Blast in the Foundry.

The foregoing may be of more or less interest to you, but I take it that what more nearly concerns you, and which you may ask: "Does sand-blast pay for foundry use?" I say yes. But as I said before, it is difficult to approximate on general work.

I am safe in saying, however, that on ordinary iron, steel, brass and bronze castings, one man, operating a sand-blast apparatus consuming 120 cubic feet of air per minute, will clean more surface and remove more cores in a given time than is possible for from six to ten men to do with hammers, chisels and brushes. And the finished work left by the sand-blast is infinitely better than what can possibly be done by hand laborers. I have proved this repeatedly. I have never yet seen the burnt sand or scale that sand-blast would not remove, and remove rapidly. Not only is it a great saving in time and labor in the actual cleaning of castings, but a further saving is made in castings to be machined. The removal of the oxide in itself is a great saving on tools, and in many cases the tools can be run at an increased speed. This particularly applies to milling cutters.

Difficult and intricate cores are readily removed and have greatly astonished some of our well-known engineers. One peculiar thing in cleaning steel castings in which large quantities of wire nails are used is the cores. When subjected to the sand-blast the sand is eaten away first, and subsequently the nails will fall to the ground, sand-blasted perfectly clean and in condition to be used over again. I could give you many instances that have come under my notice of the quick removal of cores, and will mention one that was accomplished in five minutes. This was considered to be a job of from three to four hours for one man with hammer and chisel.

Quite a number of people who have adopted the sand-blast recently and who previously used facings have discontinued the use of such, and have assured me that the sand-blast has enabled them to reduce the cost of their product.

In conclusion I would say that the only objection to sand-blast that can be found to its use in foundries is that it has an unpleasant trick of showing up defects and making them plainly discernible. This, of course, is of small moment to you, as I take it that all of you make only good castings.

INDUSTRIAL SUMMARY.

New Buyers in the Market, and Some of Their Wants:—

[If you are in need of machinery of any description, please notify *The Iron Trade Review* and we will put you in communication with our advertisers at once.]

John Laloge of Birmingham, Ala., and M. Corringo of Houston, Texas, have organized a company with a capital of $10,000, to erect a nut and bolt works at Birmingham, Ala.

The National Mold & Casting Co. has been organized at Beaver Falls, Pa., to manufacture iron and steel castings. The capital stock is $12,000. Frank F. Brierly is interested.

The New York Pipe & Machine Co., of Brooklyn, N. Y., has been incorporated, with a capital of $30,000, by Jacob New, J. W. Cassel, L. H. Brinkman, G. T. Cahill, M. A. Vosberg and F. D. Wilson.

The Cole Machine Co., of New York City, has been incorporated, with a capital of $100,000. The directors are: Henry W. N. Cole and W. L. Cole of Brooklyn, D. M. Lowrey of Philadelphia and A. W. Bronson and A. H. Bronson of New York City.

The O. S. Platt Mfg. Co., of Bridgeport, Conn., has been incorporated with $35,000 capital, and will manufacture switches and electrical appliances, patterns for castings and other light machine work. The incorporators are: O. D. Platt, C. J. Knapp, F. C. M. Smith and J. C. Chamberlain.

The Snead-Van Alstine-Meldrum Co., a new corporation in Louisville, Ky., has purchased the foundry business of Snead & Bibb, and will manufacture architectural iron work. The company is composed of Chas. G. Snead, president; David Van Alstine, vice-president, and Geo. F. Meldrum, secretary and treasurer.

A. Y. McDonald Co., 168 Lake st., Chicago, is in the market for one Baker or other pressure blower, with or without engine attached, for a No. 6 cupola; one 63 inch shell cupola; an elevator of not less than 3,000 pounds capacity for cupola room, and an eight by 12 upright engine. All of these must be in good condition, either new or second hand.

Fires and Accidents:—

Iron ran from the Kemble furnaces at Riddlesburg, Pa., March 6, and reaching a well, exploded. The hoisting towers and stockhouses were destroyed. The loss is several thousand dollars.

The shovel works of Hubbard & Co., Pittsburg, were burned March 8, loss $100,000; insurance $50,000. C. H. Myers & Co., of Beaver Falls, have offered to run their works double turn to fill imperative orders of Hubbard & Co.

Fire in the Garvin Bldg., on Laight st., New York, March 6, caused a loss of $300,000 to various companies. The Garvin Machine Co., which manufactured bicycles, typewriters, and machine tools, lost $175,000, covered by insurance.

By the explosion of a gasoline tank in the plant of the Racine Hardware Co., Racine, Wis., the entire plant was destroyed March 3. Four men were seriously injured. The explosion and resultant fire caused a loss of $150,000. The plant and contents were fully insured. The company manufactured gas and gasoline and small steam engines, and had a large stock of completed engines and unfinished material on hand. Thos. Kann & Co., of Chicago, are the principal stock holders in the company.

New Construction:—

The Acme Manufacturing Co., Reading, Pa., will put up new buildings, 40x190 feet, to be finished July 1.

C. M. & J. B. Hart, Clarksburg, W. Va., machine shop proprietors, will buy $10,000 worth of machinery to be placed in temporary quarters. A new plant is being planned.

The Niagara Falls (Ont.) Metal Works Co. has let the contract for its new factory and has ordered machinery. The building will be of brick, two stories, 120x40 feet, with two wings. Two other buildings will be 48x36 feet and 30x14 feet.

Work is going forward on the new tin plate plant to be erected at South Connellsville, Pa. Foundations are laid and as soon as a side-track is completed the structural iron for the buildings, now ready for shipment from the works of Wm. B. Scaife & Sons, Pittsburg, will be erected. It is expected that operations will be started July 1. The machinery which has been ordered from the Frick Co. is well along.

The Berlin Iron Bridge Co., of East Berlin, Conn., has just completed for the Citizens' Gas Co., at Bridgeport, Conn., two large buildings, one 63 feet wide by 171 feet long, comprising a purifier house, a meter house and valve house, and the second building 44 feet wide by 122 feet long comprising a generator house, a scrubber house and engine room. The side walls are of brick and the roof trusses of steel covered with corrugated iron.

Additions, Enlargements, Removals, Etc.:—

The Whitin Machine Works, of Whitinsville, R. I., have begun the construction of an addition to their foundry. The new building will be 100x60 feet.

At Greensburg, Pa., the Kelly & Jones iron and brass works will be enlarged. At present 500 men are employed; the additions will make room for 300 more.

The W. & B. Douglass Pump Co., of Middletown, Conn., will build an addition to its factory, three stories and 50x100 feet. It will be used exclusively for the manufacture of electric pumps.

Negotiations are being made with the Wagoner Mfg. Co., Hamilton and Sidney, O., for the removal of its foundry and machine shop to Muncie, Ind. The company makes a specialty of lathes.

Fairbanks, Morse & Co. will remove on May 1, from their present location at Lake and LaSalle sts., Chicago, where they have been for many years, to the northeast corner of Monroe and Franklin sts.

The Warren (O.) Casting Works will move to Youngstown, O., about April 1, and be known as the Youngstown Casting

MOUNT SAVAGE FIRE BRICK.

UNION MINING CO.,

Proprietors of the CELEBRATED Mount Savage Fire Brick.

GOVERNMENT ‡ STANDARD.

Established 1841. Capacity, 60,000 Per Day; 18,000,000 Per Year.

The First Manufactory of its Kind in the U. S.

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THE AMERICAN SMOKELESS FURNACE CO.

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Both ARE SMOKELESS.

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THE AMERICAN FIRE BRICK & CLAY CO., Mineral Point, Ohio.

HIGH GRADE FIRE BRICK for

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—All Shapes in Stock—

Our large capacity, 8,000,000 annually, and modern plant, enable us to handle contracts of any size promptly.

Ground or Calcined Clay in Sacks or Bulk.

RUST PERMANENTLY PREVENTED on bright Machinery & Metals by using MANNOCITIN

Leading R.R's and Factories use it. O. GOETZE, Sole U.S. Agt. 19 Whitehall St. N.Y.

"THE IRON TRADE REVIEW" is an increasingly valuable medium through which to sell equipment to machine shops and foundries.

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Mount Savage and Queen's Run Fire Brick,

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MANUFACTURERS OF

OHIO FIRE BRICK. ALL SHAPES IN STOCK.

The largest shippers of FIRE BRICK in the West.

Warehouse and Docks: 185-193 Merwin Street, CLEVELAND, OHIO.

Co. The Youngstown Malleable Foundry is leased for a term of years. E. E. Carter and Thomas Lightbody are members of the firm.

The Howard & Bullough American Machine Co., of Pawtucket, R. I., is to make many changes in its plant, the improvements including additions to the foundry and machine shops, which will double their capacity, and also the erection of a cotton mill.

Pullman's Palace Car Co. is adding to its plant at Pullman, Ill., an iron working machine shop, intended to increase the capacity of the freight car department. It will cover over 25,000 square feet of floor space, and when fully equipped will contain some $70,000 worth of machine tools.

The latest report is that arrangements have been completed by which the plant of Geo. B. Sennett, of Meadville, Pa., manufacturer of oil well supplies, will be removed to Youngstown, O. New Castle, Pa., claims to have a chance for this industry, also, the statement being made that Mr. Sennett owns a manufacturing site there.

John Mohr & Son, 32 to 42 Illinois st., Chicago, are rebuilding their South Chicago works, with the intention of making it one of the best equipped boiler making plants in the country. The equipment will consist of modern appliances for handling heavy work, including electric traveling cranes, very large shears and punches, hydraulic riveters, etc. The machinery will be driven by independent electric motors. Sargent & Lundy, Monadnock Bldg., Chicago, are making the electric installation.

The Woodstock Iron Works, Anniston, Ala., have completed the repairs upon their coke furnace, enlarging its capacity to 160 tons a day, have erected a new hot air stove and a new blowing engine of 600 h. p. built by the Reading Iron Co. Other extensive additions and repairs have been made and the plant is now in first class order. The company has a large stock of coke on hand, and an abundant supply of ore, but will not blow in the furnace until the iron market shows a more permanent improvement in the consumptive demand.

General Industrial Notes:—

Juniata furnace, Newport, Pa., has blown in.

Hecla Furnace of the Hecla Iron & Mining Co., at Ironton, Ohio, has resumed blast.

The plant of the Pittsburg Tool Steel Co., Greensburg, Pa., has been put in operation after an idleness of several months.

The Gracey-Woodward Furnace, at Clarksville, Tenn., has been blown out, but will probably be started up within a short time.

The largest year's business by the Phœnix Iron Works, Cleveland, was done in 1895. Prospects for this year are excellent.

The furnace at Paducah, Ky. is to be sold to satisfy a mortgage. The furnace was built ten years ago, but has never been operated.

It is anticipated that pig iron, scrap and manufactured product on hand at the Ohio Falls Iron Works, New Albany, Ind., will be sold out at public sale.

The Reading Iron Co., of Reading, Pa., operating the Montour Rolling Mills, has notified the employes of a reducti on in wages of 8½ per cent.

Wm. B. Pollock & Co., of Youngstown, O., have the contract for two 200 h. p. Scotch marine boilers to be placed in the water works plant at that place.

The new eight-inch mill at the Central Iron & Steel Co.'s plant at Brazil, Ind., has been started and is working double turn. It will make smaller iron than has formerly been made.

J. H. Hillman & Co., Pittsburg, have been appointed selling agents for Western Pennsylvania, Eastern Ohio and West Virginia for the Pulaski (Va.) Iron Co.'s foundry pig iron.

The Trump Mfg. Co., of Springfield, O., has sold to the Oswego, N. Y. street car company for its new power house two

U. BAIRD MACHINERY CO.

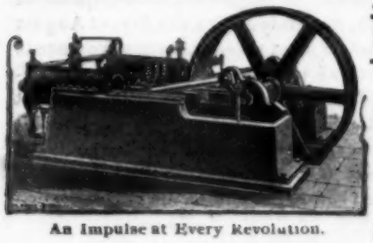
PITTSBURG, PA.

Have a Special Lot of Second-Hand Tools. All in First-Class Condition.

2—No. 10 Sturtevant Pressure Blowers.
1—55" Allen Riveter.
1—24"x12' New Haven Engine Lathe.
1—38"x14' New Haven Engine Lathe.
1—Bement Car Axle Lathe.
1—24x24x7 ft. New Haven Planer.
1—30x30x8 ft. Harrington Planer.
1—36x36x18 ft. Sellers Planer.
1—36x36x20 ft. N. Y. Steam Engine Co. Planer.
4—No. 1 Brown & Sharpe Screw Machines.
2—15" Hendey Shapers.
1—Newton Column Milling Machine.
4—No. 11 Brown & Sharpe Milling Machines.

AND MANY OTHERS.

We have all the best makes of New Tools. Send for Second-Hand List.



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Large Double Engines, Gas or Gasoline, for Driving Flouring Mills, Electric Light Plants, Etc., a Specialty.

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AN INVENTION OF INESTIMABLE VALUE TO THE MINERAL WORLD.

Now ready, machinery and process by which all small or flux ores can be prepared in any shape or size desired, ready for the cupola or furnace, at a very small cost.

Experts pronounce this invention most valuable, furnishing an inexpensive method for utilizing the soft and waste ores and thus reclaiming a large percentage of the most superior minerals.

For terms, machinery, territory, etc., address

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STEEL CASTINGS.

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Light Castings from One to One-Hundred Pounds a Specialty.

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MINING AND METALLURGICAL ENGINEERS AND CONSTRUCTORS.

Sole owners in America of the

WALRAND-LEGENISEL STEEL PROCESS.

We are now prepared to place licenses for the use of the WALRAND LEGENISEL process, and to undertake the design and construction of plants with supervision of preliminary operation. The process can be seen in operation at the works of POTTER & HOLLIS FOUNDRY CO., This process is unequaled for the manufacture of solid and flawless steel castings or for any purpose requiring sound masses of steel.

OFFICE, 525 ROOKERY, CHICAGO.

Trump turbine water wheels. They will develop 642 h. p. on a horizontal shaft.

The Chicago Pneumatic Tool Co. recently received orders for two of its tools from France, three from Russia, two from New Zealand, four from Australia and one from Austria, and shipped 10 to London.

The Buffalo Iron Co., of Chattanooga, Tenn., has blown out the furnace at Mannie, Tenn., for the purpose of making repairs. Furnace No. 2, at the same place, is not in operation, and will not go into blast until next fall.

At Akron, O., the Carnegie Steel Co., Ltd., has filed a cross-petition in the litigation over the defunct P., A. & W. Railroad, asking judgment for $70,000 on a note given by the contractors who built the road, and endorsed by the railroad company.

Chas. E. Pope & Co., Pittsburg, have been appointed selling agents for merchant bars and other products of the Junction Iron & Steel Co., Mingo Junction, O., for Western Pennsylvania, Western New York, Eastern Ohio, West Virginia and Southern Michigan.

Henry P. Hill, for several years with Hill, Clarke & Co., of Boston, has opened store rooms for the sale of machine tools at 123 Oliver street, Boston. Mr. Hill will handle all kinds of standard and special tools, particularly those designed for bicycle manufacture.

The old Wampum furnace, near New Castle, Pa., built in 1856 by P. F. Freed & Co., of Pittsburg, is being removed to be sold for junk. It was in operation for some years, but profits were small. It was sold to a Cleveland firm in 1865 and was operated by the Wampum Furnace Co. Operations were finally suspended in 1878.

The operation of the Brown Hoisting & Conveying Machine Co.'s plant, Cleveland, O., 24 hours a day will be necessary throughout the spring months to take care of contracts on hand, one of these being for a large equipment of ore handling machinery. The crane business of the company is also developing satisfactorily.

A good business in engines is reported by the Lane & Bodley Co., Cincinnati. Electric light plants are modifying their speed of operation, so that Corliss engines are now being used. A Corliss engine coupled direct to the dynamo is in use in one plant. A Lane & Bodley engine has been shipped recently to Arequipa, Peru.

The Diamond Machine Co., of Providence, R. I., has just

perfected a new and improved machine for grinding cotton mill spindles from the forging. The machine is a combination of the maker's universal and knife grinders, with the necessary attachments for grinding the spindles to the proper taper. It has given excellent satisfaction, and although but recently completed, orders have been placed by several manufacturers of spindles.

Operations have been suspended by the Dorner Foundry Co., of Hudson, O. The foundry became unprofitable owing to a recent conflict with the molders' union.

H. E. Collins & Co., Bank of Commerce Bldg., Pittsburg, sole sales agents for the Cahall vertical water tube boiler, manufactured by the Aultman & Taylor Machinery Co., Mansfield, O., report the following sales of Cahall boilers made within the last few days: 1,000 h. p. for the Pittsburg Plate Glass Co., Kokomo, Ind.; Brown & Co., Pittsburg, 100 h. p.; Jones & Laughlin, Ltd., Pittsburg, 500 h. p. The boilers for the Pittsburg Plate Glass Co., are of the standard direct-fired type. Those for Jones & Laughlins will be equipped with the chain grate stoker, and that for Brown & Co. is of the waste heat type.

Among the new purposes for which Hadfield manganese steel made by the Taylor Iron & Steel Co., of Highbridge, N. J., is being used is that of cast, perforated curved plates for the shell of a large trommel or rotary screen which is used for sizing crushed stone for macadamizing or other purposes at the Rockland Lake plant of Cosgriff, Conklin & Foss, one of the largest producers of crushed stone on the Hudson River. There are 40 plates on each screen. The holes are ¾ in., 2 in., and 2¼ in. All the plates are ¼ in. thick. The holes are cored of course. Such castings are difficult to make of any material, but the advantages to be gained by the use of this material for this purpose fully warranted an attempt to overcome the obstacles presented in casting them of manganese steel. It is impossible to predict what the life of these plates will be in service but it will be very great.

The Cramp Shipbuilding Co. has issued a statement of the business results for nine months ending Jan. 31, showing gross receipts of $3,817,494, and expenses (including taxes, insurance and sinking fund) of $3,543,698, leaving a surplus of $273,795. The statement adds: "The results of the business would justify, therefore, the declaration of the regular dividend, but owing to recent disturbances in the money market it was found necessary to enter into an arrangement—which has just been consummated—to fund the floating indebtedness of the company to the extent of $1,500,000, to be payable at the rate of $50,000 a month, beginning with the first of August next, and to provide a fund to meet these monthly payments and to retire other obligations presently maturing, it was determined that no dividend should be declared at this time. It is believed by the board that such a substantial reduction will have been made in the current obligations of the company in the course of the next few months that the payment of dividends may be resumed before the end of the current year."

Steam Yachts and Marine Machinery,

Also Towing Launches built by Marine Iron Works, Clybourn and Southport avenues, Chicago. Free illustrated catalogue. Write them for it.—*Adv.*

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Fan System Heating and Ventilation.

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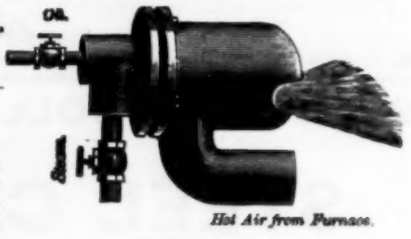

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NOTE.—If you are using oil as fuel, and are not getting good results, we would be pleased to send you our burners on trial. The oil in our burners can be atomized by either steam or air.

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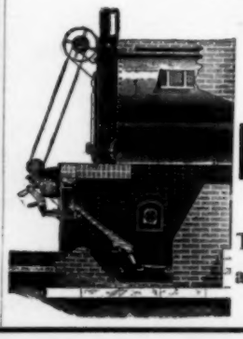

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Those who take the trouble to visit Foundries or other places where Ridgway Cranes are used, are struck always by the warmth, earnestness and enthusiasm with which the "boss" talks about the crane. So much so indeed, that some of the users of the cranes have been suspected of getting a "divvy" on future sales.

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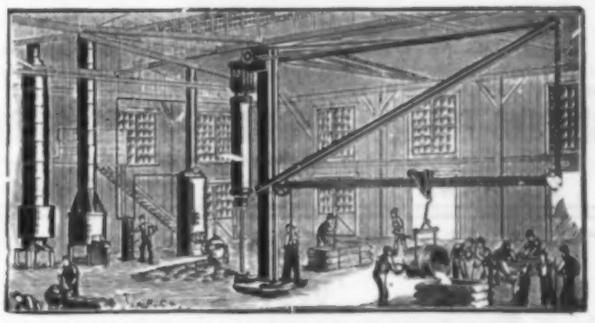

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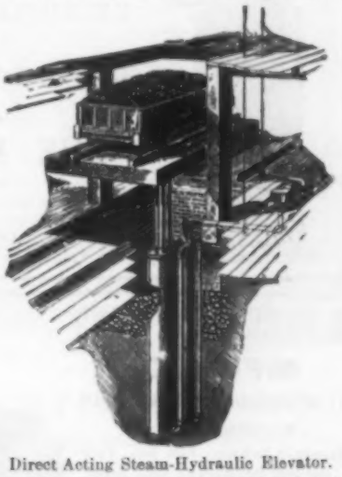
When you put a machine in a man's shop which enables him to save money by leaps and bounds, it loosens his tongue and his rhetoric as nothing else will do.

We don't suppose there is a machinery maker anywhere who has as many warm friends as we have. All of our customers are more than mere customers. Every one is a salesman, and a salesman from love, which is the best salesman yet.

Why is this? Because every word we say about this crane is true. No exaggeration, no selling promises that don't prove practical fulfillments. It makes the money we say it will. And you

"Please Take the Elevator."

THE BEST FOUNDRY STOCK HOIST.



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CRAIG RIDGWAY & SON, COATESVILLE, PA.

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Seamless Steel Tubes,

For Hydraulic Tubes, Jacks, Presses and Hoists, Lathe Spindles, Bicycle Hub Stock, Projectiles, Hollow Shafting, Shells for Carbonic Acid and other Gases, Piston and Valve Rods, Axles, Bolts and Columns, Working Barrels, Roller Bearings, Bushings, Couplings, Boiler Tubes and other purposes where

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Our tubes are hot drawn, without weld or seam; from the best quality of steel, in lengths from 8 to 25 feet, and of any degree of hardness, from .08 to .60 carbon —They are equal in every respect, except finish, to cold drawn tubes and are offered at a much lower price.

For special work, requiring extremely low sulphur and phosphorus, we are prepared to guarantee a maximum of

.020 SULPHUR and .015 PHOSPHORUS.

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Kellogg Weldless Tube Co.,
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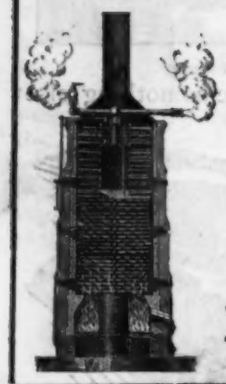

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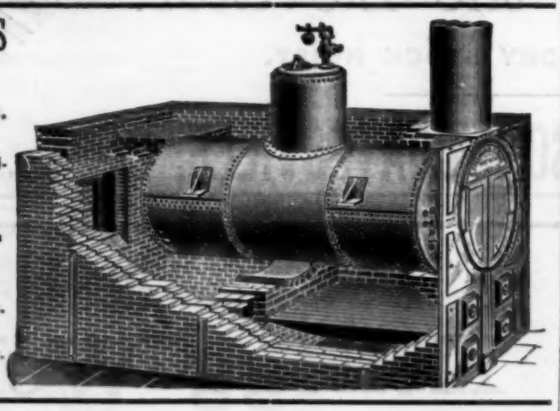

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It depends upon getting the HEAT to the SURFACE.

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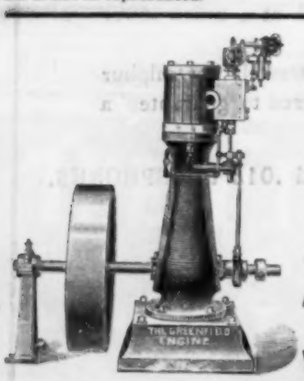

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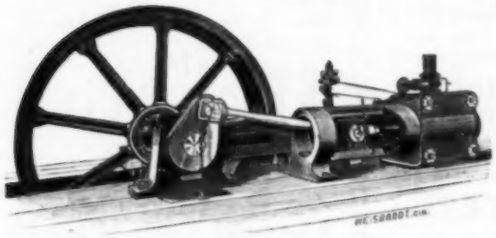

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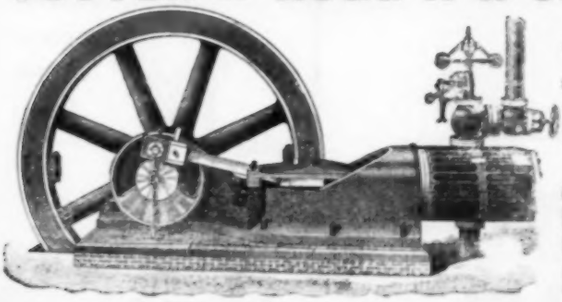

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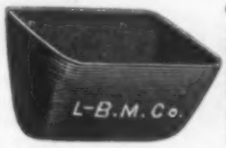

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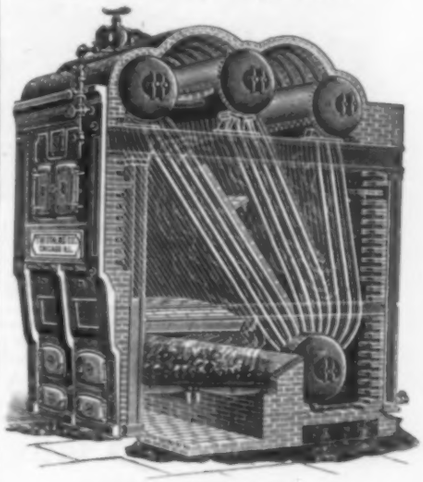

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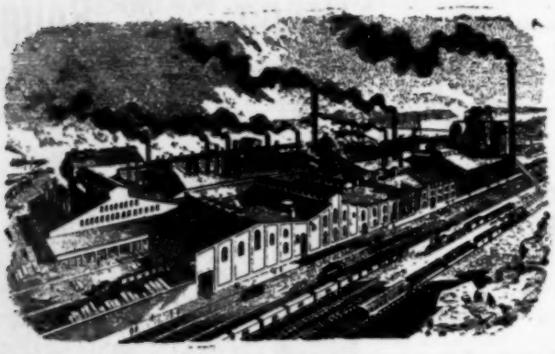

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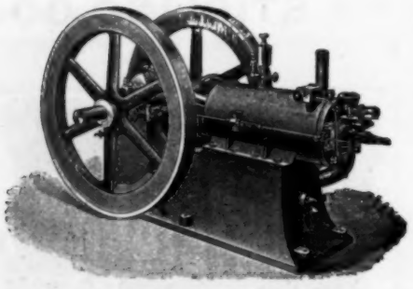

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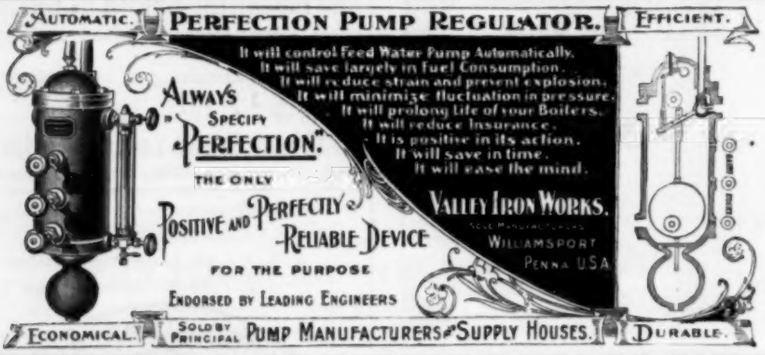
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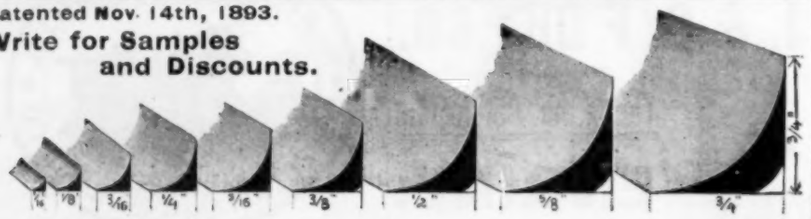

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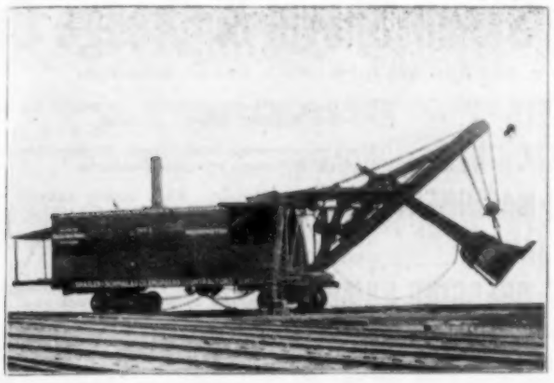

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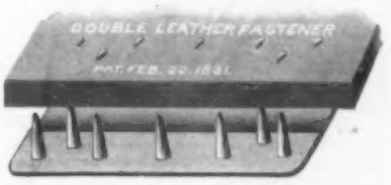

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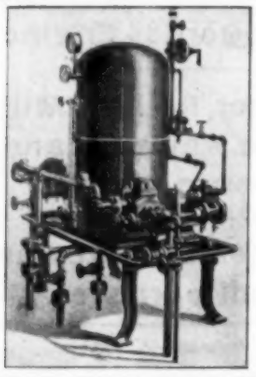

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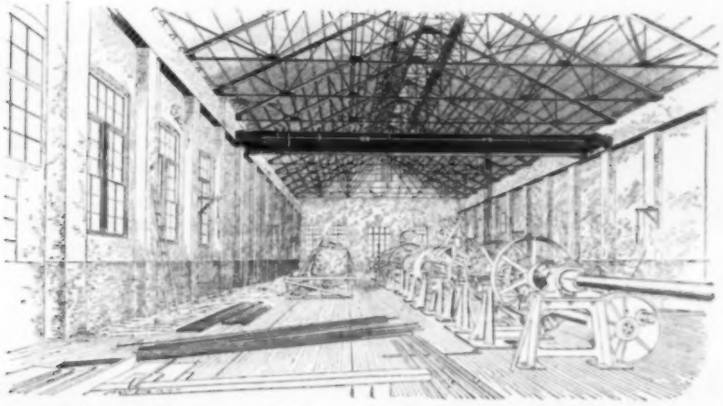

The above illustration was taken direct from a photograph and shows the interior of the Dynamo Room in the Electric Lighting Plant of the Elmira Illuminating Co., at Elmira, N. Y. Besides this, there is a Boiler and Engine Room adjacent to the Dynamo Room. We furnished the Traveling Crane as well as the Iron Roof. The roof is covered with our Patent Anti-Condensation Corrugated Iron, and is guaranteed absolutely fire-proof, and not to drip from the under side during the coldest weather. The photograph was taken after the roof trusses and traveling crane were placed, but before the machinery was started.

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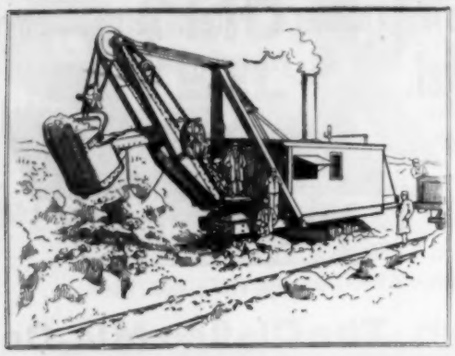

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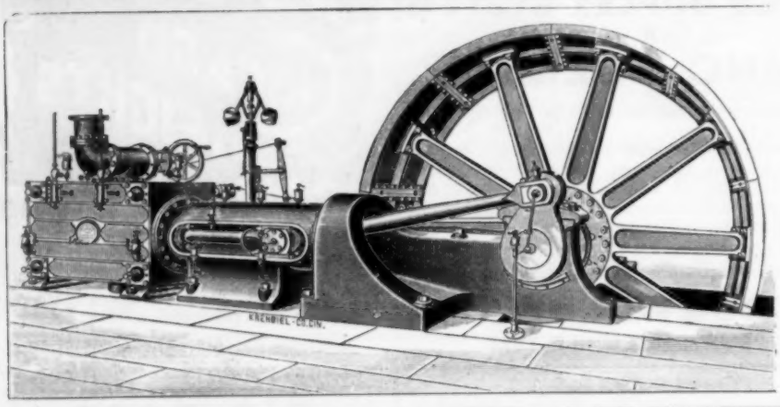

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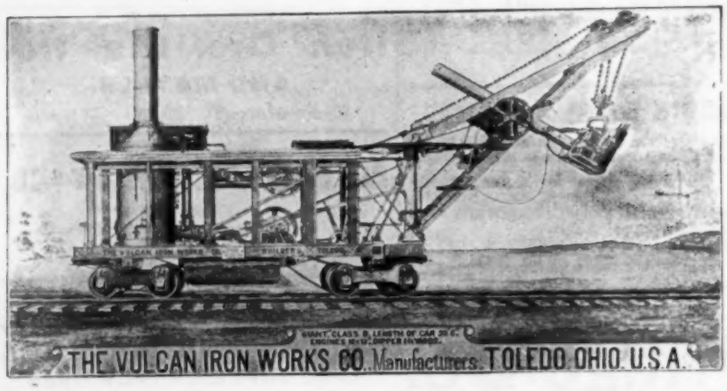

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Our "Giant" has the record on the Mesabi Range.

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Sample piece of FLUE taken from Locomotive No. 725 running for 7 months on Western Division of N.Y.C.&H.R.R.R. showing amount of SCALE adhering in that time.

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RECEIVER'S SALE.

The manufacturing plant of the Joliet Enterprise Company is now offered for sale. This property consists of Twenty (20) acres of land, situate in Will County, Illinois, and described as that part of the East Half of the North-West Quarter of Section Twenty (20), Township Thirty-five (35) North and of Range Ten (10) East of the Third Principal Meridan, as lies between the right-of-way of the Chicago, Rock Island & Pacific Railway Company on the North and the Illinois and Michigan Canal, including its reserve strip, on the South, together with all the buildings and improvements situate thereon, and the tools, machinery, appliances, boilers, engines and other articles of personal property, situate in said buildings or located upon said property, heretofore obtained, used and employed for the purpose of carrying on, on said real estate, a manufacturing business, such as was carried on by the Joliet Enterprise Company, prior to the appointment of the Receiver, together with all right, title and interest of said corporation, George M. Fish or the Receiver in and to the Capital Stock of the Columbia Wire Company and Columbia Patent Company or both, with all rights and privileges thereunder, it being the intent and purpose to sell all said real estate and other property as a whole, undivided and as a manufacturing plant and so convey the same.

This sale is by the direction of the Circuit court of Will County, Illinois, which has had jurisdiction of the Joliet Enterprize Company and its assets for over three years, in a suit to wind up the corporation and distribute its assets among its creditors and under a decree for a sale without redemption, which has already been affirmed by the Supreme Court of the State of Illinois.

This plant is modern and complete in all its appointments having been operated only about ninety (90) days. The capacity of the plant is Two Hundred (200) tons and upwards of rods per day. It has One Hundred (100) drawing blocks, Seventy-five (75) barbed wire fence machines, Eight (8) bale tie machines, Thirty-six (36) wire nail machines. Its location is the best and just outside the City limits of the city of Joliet. Freight rates are the same as Chicago. The buildings are constructed of brick on stone foundations. On the North it is connected with the Chicago, Rock Island and Pacific Railway and on the South with the Illinois and Michigan Canal. There is nearly a mile of side tracks along side of and connected with this property. The warehouse is in a safe location and is One Hundred and Twenty (120) by Four Hundred (400) feet in size. The machine shop is large, and thoroughly equipped with all modern machinery and appliances. The buildings are heated by steam and the mill is supplied throughout with fire pipes, hose and chemical engines, and is lighted by electricity, the electrical plant being situate on the premises. In addition to water supply from the Canal, it has a large artesian well of the best quality of water for domestic and steam purposes. The mill has full privileges and protection under the patents of the Columbia Wire Company.

The sale will be made for cash and without redemption, free of all mechanics liens or other liens of parties to the cause in which the Receiver is appointed.

Sealed bids for this property will be received by the undersigned, as such Receiver, up to Twelve o'clock Noon of April 8th, 1896. The bids will be turned over to the Court and will be opened in Court at One-thirty o'clock P. M. of said day and then made public. A certified check on some National Bank for Five Thousand Dollars ($5,000) payable to the order of the Receiver, must accompany each bid.

The Court expressly reserved the right to reject any and all bids.

An inspection of the mill may be had and any further information obtained by application to the undersigned, as such Receiver, at Joliet, Illinois. March 4th, 1896.

GEORGE H. MONROE, Receiver.

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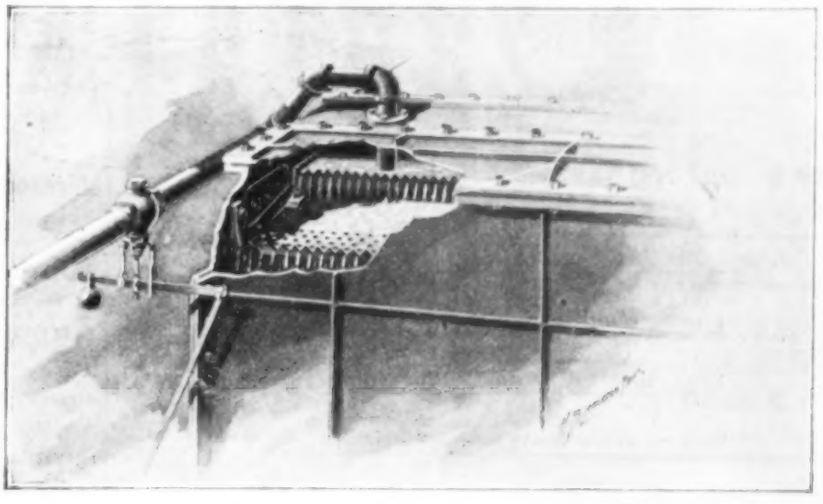

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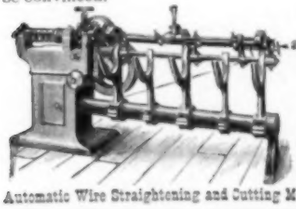

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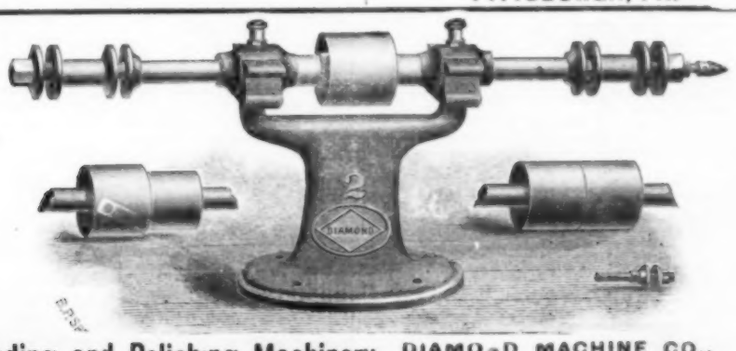

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The Largest and Most Completely Equipped Electrical Manufacturing Establishment in the World.

POWER, INCANDESCENT AND ARC LIGHTING, FROM THE SAME CIRCUITS.

We have purchased and are the **sole owners** of the patents issued to Nikola Tesla for the **Polyphase Alternating System,** now recognized to be the most successful system for lighting and power purposes.

We furnish complete lines of apparatus for the perfect equipment of **isolated plants** for Hotels, Office Buildings, Flats and Factories.

STANDARD SYSTEMS

For distribution of lights and power in **large Manufacturing Establishments, Mills and Mines.**

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The most durable, economical and efficient on the market.

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CHARLOTTE, N. C., 23-28 College St.
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Link-Belt Machinery Co. Chicago, Ill.

Lathes—
Prentiss Tool & Supply Co., Chicago, Ill.
Davis & Egan Machine Tool Co., Cincinnati, O.
Lodge & Shipley Machine Tool Co., Cincinnati
U. Baird Machinery Co., Pittsburg, Pa.
The Wright Co., Lowell, Mass.
Springfield Machine Tool Co., Springfield, O.

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Prentiss Tool & Supply Co., Chicago, Ill.
H. Bickford, Lakeport, N. H.
Davis & Egan Machine Tool Co., Cincinnati, O.
C. H. Besly & Co., Chicago, Ill.
Armstrong Bros. Tool Co., Chicago, Ill.
Diamond Machine Co., Providence, R. I.
U. Baird Machinery Co., Pittsburg, Pa.
The L. S. Starrett Co., Athol, Mass.
American Tool Works, Cleveland, O.
Skinner Chuck Co., New Britain, Conn.
Bertsch & Co., Cambridge City, Ind.
Lodge & Shipley Machine Tool Co., Cincinnati
C. H. Haeseler & Co., Philadelphia, Pa.
Springfield Machine Tool Co., Springfield, O.

Machine Screws—
Illinois Screw Co., Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.

Machine Shops—
Toledo Machine & Tool Co., Toledo, O.
Hamilton Fdy. & Machine Co., Hamilton, O.
Springfield Machine Tool Co., Springfield, O.

Magnesia Covering—
C. H. Besly & Co., Chicago, Ill.

Manufacturers' Advertising—
United States Mailing Co., Cleveland, O.

Metallic Lath—
The Cincinnati Corrugating Co., Piqua, O.

Metal Saws—
Q. & C. Co., Chicago, Ill.

Milling Machines—
Prentiss Tool & Supply Co., Chicago, Ill.
Davis & Egan Machine Tool Co., Cincinnati, O.
Lodge & Shipley Machine Tool Co., Cincinnati.

Mining Machinery—
Bucyrus Steam Shovel & Dredge Co., Bucyrus, O.
Vulcan Iron Works Co., Toledo, O.
C. H. Besly & Co., Chicago, Ill.
The Edward P. Allis Co., Milwaukee, Wis.
American Hoist & Derrick Co., St. Paul, Minn.
Willis Shaw, 416 N. Y. Life Bldg., Chicago.
Link-Belt Machinery Co., Chicago, Ill.

Motors—
Westinghouse Electric & Mfg. Co., Pittsburg.

Molding Sand—
Ohio Sand Co., Conneaut, O.

Molding Machines—
Tabor Mfg. Co., New York City.

Nickel—
Canadian Copper Co., Cleveland, O.

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Oil Cups—
C. H. Besly & Co., Chicago, Ill.

Oil Pumps—
C. H. Besly & Co., Chicago, Ill.

Ore Crushers—
The Edward P. Allis Co., Milwaukee, Wis.
American Hoist & Derrick Co., St. Paul, Minn.

Packing—
C. H. Besly & Co., Chicago, Ill.

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Iron Clad Paint Co., Cleveland.
Jos. Dixon Crucible Co., Jersey City, N. J.
Standard Paint Co., New York City.

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Canton Leather Fillet Co., Canton, O.

Pattern Works—
Gobeille Pattern Co., Cleveland, O.

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Harrington & King Perforating Co., Chicago, Ill
Aitchison Perforated Metal Co., Chicago.

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Prentiss Tool & Supply Co., Chicago, Ill.
Davis & Egan Machine Tool Co., Cincinnati, O.
Lodge & Shipley Machine Tool Co., Cincinnati.
U. Baird Machinery Co., Pittsburg, Pa.

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Power Presses—
Springfield Machine Tool Co., Springfield, O.

Portable Forges—
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Cady Mfg. Co., Cleveland, O.
C. H. Besly & Co., Chicago, Ill.
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Toledo Machine & Tool Co., Toledo, O.
Cady Mfg. Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.

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Link-Belt Machinery Co., Chicago, Ill.

Pulley Blocks—
Moore Mfg. & Foundry Co., Milwaukee, Wis.
American Hoist & Derrick Co., St. Paul, Minn.
Willis Shaw, 416 N. Y. Life Bldg., Chicago.

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Battle Creek Steam Pump Co., Battle Creek, Mich.
Deming Co., Salem, O.
The Edward P. Allis Co., Milwaukee, Wis.
Willis Shaw, 416 N. Y. Life Bldg., Chicago.

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Valley Iron Works, Williamsport, Pa.

Pyrometers—
Edward Brown, Philadelphia, Pa.

Railway Supplies—
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Retort Coke Ovens—
Semet-Solvay Co., Syracuse, N. Y.

Rock Breakers—
American Hoist & Derrick Co., St. Paul, Minn.

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The Cincinnati Corrugating Co., Piqua, O.

Roofing Plates—
Morton Tin Plate Co., Cambridge, O.
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The Lloyd-Booth Co., Youngstown, O.

Sand Blast Machines—
Ward & Nash, Chicago, Ill.

Saws—
Peter Gerlach & Co., Cleveland.

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Harrington & King Perforating Co., Chicago.

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Klein & Cohn, Cincinnati, O.

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Illinois Screw Co., Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.
Upson Nut Co., Cleveland, O

Second-Hand Machinery—
Prentiss Tool & Supply Co., Chicago, Ill.
American Tool Works, Cleveland, O.

Semi-Steel—
McDowell Steel Co., Chicago, Ill.

Shapers—
Springfield Machine Tool Co., Springfield, O.

Shafting—
Finished Steel Co., Youngstown, O.

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Toledo Machine & Tool Co., Toledo, O.
Cady Mfg. Co., Cleveland, O.
Long & Allstatter Co., Hamilton, O.

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Berger Bros., Philadelphia, Pa.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
The Cincinnati Corrugating Co., Piqua, O.

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American Smokeless Furnace Co., Cleveland, O.
Brightman Furnace Co., Cleveland, O.
Playford Stoker Co., Cleveland, O.

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Toledo Machine & Tool Co., Toledo, O.
Cady Mfg. Co., Cleveland, O.

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Wm. B Scaife & Sons, Pittsburg, Pa.

Stamping and Punching—
Cady Mfg. Co., Cleveland, O.

Steam Boiler Inspectors—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.

Steam Pipe and Boiler Covering—
C. H. Besly & Co., Chicago Ill

Steam Packing—
C. H. Besly & Co., Chicago, Ill.

Steam Shovels and Dredges—
Bucyrus Steam Shovel & Dredge Co., Bucyrus, O
Vulcan Iron Works Co., Toledo, O.
Vulcan Iron Works, Chicago, Ill.

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Potter & Hollis Foundry Co., Chicago, Ill.
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Samuel Tretheway & Co., Pittsburg, Pa.

Steel Rails, Blooms and Billets—
Cleveland Rolling Mill Co., Cleveland.
Bethlehem Iron Co., South Bethlehem, Pa.
Cambria Iron Co., Johnstown, Pa.

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J. H. Fleharty & Co., Cleveland.

Steel Shafting—
Finished Steel Co., Youngstown, O.

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Berlin Iron Bridge Co., East Berlin, Conn.

Stokers—
Playford Stoker Co., Cleveland, O.

Structural Engineers—
Berlin Iron Bridge Co., East Berlin, Conn.

Turnbuckles—
Cleveland City Forge & Iron Co., Cleveland.
Central Iron & Steel Co., Brazil, Ind.

Tanks—
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Enterprise Boiler Co., Youngstown, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.

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Universal Telephone Co., Indianapolis, Ind.

Time Detector—
Nanz & Co., New York.

Tinning Machinery—
The Lloyd-Booth Co., Youngstown, O.

Tin Plate—
Gummey, McFarland & Co., Philadelphia, Pa.
Morton Tin Plate Co., Cambridge, O.
Atlanta Steel & Tin Plate Co., Atlanta, Ind.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
The Cincinnati Corrugating Co., Piqua, O.

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Dangler Stove & Mfg. Co., Cleveland, O.

Tool Steel—
Wm. Jessop & Sons, Ltd., New York, N. Y.
C. H. Besly & Co., Chicago, Ill.

Tube Welding—
S. Fix Sons, Cleveland.

Twist Drills—
C. H. Besly & Co., Chicago, Ill.

Valves—
C. H. Besly & Co., Chicago, Ill.

Ventilating Fans—
American Blower Co., Detroit, Mich.

Watchman's Time Detector—
Nanz & Co., New York.

Welding Compound—
Cornelius S. Mitchill, New York City.

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Lansing Wheelbarrow Co., Lansing, Mich

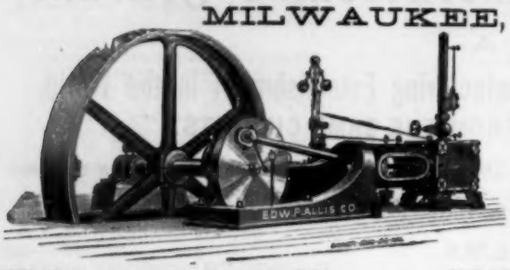
Wire Nails—
Salem Wire Nail Co., Salem, O.

Wire Rope—
American Hoist & Derrick Co., St.
Roberts Steel Chain Belting Co., Pittsburg.

Wire Machinery—
Cady Mfg. Co., Cleveland, O.
John Adt & Son, New Haven Conn.

THE EDWARD P. ALLIS COMPANY

MILWAUKEE, WIS.



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Blowing Engines, Hoisting Engines, Pumping Engines, Air Compressors, Special Engines for Electric Lighting Street Railways and Rolling Mills, Ore Crushers, Crushing Rolls, Stamp Mills, Concentrators, General Mining, Milling and Smelting Machinery.

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Reynolds Corliss Engines.

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CHICAGO, Room 509, Home Ins. Bldg
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SAN FRANCISCO, 31 Main Street.
PITTSBURG, 702 German National Bank Bldg.
SALT LAKE CITY, Deseret Bank Bldg.
KANSAS CITY, Armour Bldg.

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The star (*) indicates that the adv. appears alternate weeks; the dagger (†) once a month; the double dagger (‡) once in three weeks; the parallel (‖) three times out of four.

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If you are thinking of enlarging your mill, foundry or machine shop, or of purchasing machinery of any kind, send us a line giving character of machinery needed. We can put you in communication with manufacturers from whom you can buy advantageously.

IRON AND STEEL MARKETS.

IRON ORE.

[On Lake Erie docks.]

No. 1 Specular, Bessemer	$4.50@ 5.00
No. 1 Bessemer hematite	3.75@ 4.25
Hematites No. 1 non-Bessemer	2.25@ 2.75
No 1. Specular, non-Bessemer	2.75@ 3.25

PIG IRON.

CLEVELAND (f. o. b. cars):

Bessemer	$12 50@ 12 75
No. 1 Strong Foundry	13 00@ 13 25
No. 2 Strong Foundry	12 50@ 12 75
No. 1 Gray Forge, red short	11 25@ 11 50
No. 2 Gray Forge, neutral	10 75@ 11 00
No. 1 American Scotch	13 25@ 13 50
No. 2 American Scotch	12 75@ 13 00
Lake Superior Charcoal	13 50@ 14 25

PITTSBURG:

No. 1 Foundry	$13 00@ 13 25
No. 2 Foundry	12 50@ 12 75
Gray Forge	11 00@ 11 25
White and Mottled	10 50@ 10 75
Warm Blast Charcoal	15 00@ 16 00
Cold Blast Charcoal	20 00@ 22 00
Bessemer	12 25@ 12 40

CHICAGO (reported by our representative:)

Lake Superior Charcoal	$13 50@$14 00
Local Coke Foundry No. 1	12 75@ 13 25
Local Coke Foundry No. 2	12 25@ 12 75
Local Coke Foundry No. 3	11 25@ 11 75
Local Scotch Foundry No. 1	12 75@ 13 25
Local Scotch Foundry No. 2	12 25@ 12 75
Local Scotch Foundry No. 3	11 25@ 11 75
Southern Coke No. 1	12 00@ 12 85
Southern Coke No. 2	11 85@ 12 10
Southern Coke No. 3	11 60@ 11 85
Southern No. 1 Soft	11 85@ 12 10
Southern No. 2 Soft	11 60@ 11 85
Southern Silveries No. 1	13 75@ 13 00
Southern Silveries No. 2	12 15@ 12 75
Jackson Co Silveries	14 50@ 16 00
Ohio Silveries No. 1	15 00@ 15 50
Ohio Silveries No. 2	14 50@ 15 00
Ohio Strong Softeners	15 00@ 15 50
Alabama Car Wheel	16 85@ 17 35
Malleable Bessemer	13 75@ 14 00
Coke Bessemer	13 75@ 14 00

CINCINNATI (reported by Rogers, Brown & Co.)

Southern Coke No. 1, Foundry	$11 50@$11 75
Southern Coke No. 2 and No. 1 Soft	10 75@ 11 25
Hanging Rock Coke, No 1	12 50@ 13 50
Hanging Rock Charcoal No. 1, Fdy	16 00@ 17 00
Tennessee Charcoal No 1	13 50@ 14 00
Jackson County Silvery No 1	14 00@ 14 50
Southern Coke, Gray Forge	10 00@ 10 25
" " Mottled	9 75@ 10 00
Standard Alabama Car Wheel	15 75@ 16 25
Tennessee " "	14 50@ 15 00
Lake Superior " "	15 75@ 16 25

BUFFALO (reported by Rogers, Brown & Co.)

No. 1 Foundry Strong Coke Iron Lake Superior Ore	$13 50
No. 2 Foundry Strong Coke Iron Lake Superior Ore	13 00
Ohio Strong Softener No. 1	13 70
Jackson Co. Silvery No. 1	15 25@ 15 75
Lake Superior Charcoal	14 00
Southern Soft No. 1	12 65
Hanging Rock Charcoal	18 00

ST. LOUIS (reported by Rogers, Brown & Mecham):

Southern Coke No 1	$11 75@$12 00
Southern Coke No. 2	11 25@ 11 50
Southern Coke No. 3	10 75@ 11 00
Southern Gray Forge	10 25@ 10 50
Southern Charcoal No. 1	15 00
Missouri Charcoal No. 1	14 00@ 15 00
Ohio Softeners	16 00
Lake Superior Car Wheel	15 00
Southern Car Wheel	16 25

OLD RAILS AND SCRAP METAL.

	GROSS TONS
Old iron rails	$16 25
Old steel rails	12 00
Old car wheels	13 00
	NET TONS
No. 1 R. R. wrought scrap	$12 75
Mill scrap	10 00
No. 1 Machine cast scrap	10 00
Iron axles	16 50
Axle turnings	9 00
Wrought turnings (free from cast)	8 00
Cast borings	7 00
Uncut wrought iron boilers	5 00
Steel boiler plates	10 00
Grate bars	6 50
Pipes and flues (clean)	8 50
Tank iron	9 00
Hoop and band iron	7 00
Sheet iron	6 50
Wrought drillings	7 50
Malleable iron	9 00

STRUCTURAL MATERIAL.

Beams and Channels (Cleveland mill)	1.49c@1.54c
Angles	1.34c@1.39c
Tees	1.49c
Universal Plates	1.45c
Sheared Plates	1.55c

MERCHANT IRON AND STEEL.

[List prices out of store.]

Flat Bar.

1½ to 4 by ¼ to 1 inch	1 60
1¼ to 6 by ⅛ to 1 inch	1 65
1¼ to 6 by 1⅛ to 2 inch	1 65
1¼ & 1⅜ by ⅛ to ¼ inch	1 40
1 & 1⅛ by ⅛ to ¼ inch	1 50
⅝, ¾, ⅞, by ⅛ to ½ inch	1 60

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18, 20 and 22 Johnson St., CLEVELAND, O.

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OF ALL KINDS FOR

MILLING MINING AND AGRICULTURAL MACHINERY,

PERFORATED IRON, STEEL, COPPER, BRASS, TIN, ZINC, LEAD, ETC. TO ORDER.

LARGE AND VARIED ASSORTMENT OF SIZES. CORRESPONDENCE SOLICITED.

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A. H. LEITCH, PREST. JOHN C. LEITCH, SEC. AND TREAS.

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PITTSBURG, PA.

Works and Mines, Westmoreland, Pa.

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FOR TIN OR SHINGLE ROOFS AND IRON WORK. IT IS ABSOLUTELY WITHOUT AN EQUAL. Tin roofs well painted have not required repainting for 10 to 15 years.

If you need any paint it will pay you to send for circular.

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FOR INCANDESCENT LIGHTING IN FACTORIES AND MILLS.

We Are Making a Specialty of 30-Light Machines,

But have Larger and Smaller Sizes.

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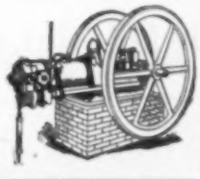
POWER From **GAS OR GASOLINE.**

No Steam, Coal, Ash, Gauges, Engineer nor Danger.

From 1 to 250 horse-power. } **Can be Used in City or Country.**



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IRON CLAD PAINT CO.

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And get the genuine article, and save liability of suit for using an article made in violation of the patents issued to Wm. Green, and now owned by this Company.

IRON CLAD PAINT is the most durable, most fire-proof and Cheapest Paint made.

FURNISHED both Dry and Ground in Oil

USED BY NEARLY ALL THE RAILROADS.

Round and Square.

1 to 1⅞ inch	1 40
2 to 2⅝ inch	1 60
2¾ to 3¼ inch	1 55
3⅜ to 4 inch	1 90
4⅛ to 4⅝ inch	2 50
4¾ to 5 inch	2 70

Oval.

⅜ to 1¼ inch	1 60
⅝ to ¾ inch	1 60
⅞	1 80
1	2 00

Half Oval and Half Round.

1¼ to 3 inch	1 95
⅜ to 1⅛ inch	1 75
½ to ¾ inch	2 00
⅞	2 15
1	2 25

Heavy Band.

1¼ to 6 by ¼ and 5-16 inch	1 50
1 to 1¾ by ¼ and 5-16 inch	1 55
¾ to ⅞ by ¼ and 5-16 inch	1 65
½ to ⅝ by ¼ and 5-16 inch	1 90

Hoop Iron.

1 7-16 to 4, No. 13, 14, 15 and 16	1 75
1 7-16 to 2, No. 17, 18 and 19	1 80
1 7-16 to 2, No. 20	1 90
1 7-16 to 2, No. 21	2 00
1 7-16 to 2, No. 22	2 10
1⅛ to 1⅜, No. 13, 14 and 15	1 80
1⅛ to 1⅜, No. 16, 17 and 18	1 85
1⅛ to 1⅜, No 19 and 20	1 90
1⅛ to 1⅜, No. 21	2 00
1⅛ to 1⅜, No. 22	2 10
15-16 and 1 inch, No. 13, 14 and 15	1 75
15-16 and 1 inch, No. 16, 17 and 18	1 90
15-16 and 1 inch, No. 19 and 20	2 00
15-16 and 1 inch, No. 21	2 10
15-16 and 1 inch, No. 22	2 20
⅞, No. 13, 14 and 15	2 00
⅞, No. 16 17 and 18	2 10
⅞, No. 19 and 20	2 20
⅞ No. 21	2 30
⅞, No. 22	2 40
13-16, No. 13, 14 and 15	2 10
13-16, No. 16, 17 and 18	2 20
13-16, No. 19 and 20	2 30
13-16 No. 21	2 40
13-16, No. 22	2 50
¾, No. 13, 14 and 15	2 20
¾, No. 16, 17 and 18	2 35
¾, No. 19 and 20	2 45
¾, No. 21	2 55
¾, No. 22	2 65
11-16, No. 13, 14 and 15	2 45
11-16, No. 16, 17 and 18	2 50
11-16, No. 19 and 20	2 60
1-16, No. 21	2 70
11-16, No. 22	2 80
11-16, No. 23	2 90
⅝, No. 13, and 15	2 50
⅝, No. 16, 17 and 18	2 60
⅝, No. 19 and 20	2 70
⅝ No. 21	2 80
⅝, No. 22	2 90
⅝, No. 23	3 00
9-16, No. 13, 14 and 15	2 70
9-16, No. 16, 17 and 18	2 80
9-16, No. and 20	2 90
9-16, No. and	3 00
9-16, No. 221	3 10
9-16, No. 22	3 20
7-16 and ½ inch, No. 13, 14 and 15	2 90
7-16 and ½ inch, No. 16, 17 and 18	3 00
7-16 and ½ inch, No. 19 and 20	3 10
7-16 and ½ inch, No. 21	3 20
7-16 and ½ inch, No. 22	3 30
7-16 and ½ inch, No. 23	3 40
⅜, No 13, 14 and 15	3 40
⅜, No. 16, 17 and 18	3 50
⅜, No. 19 and 20	3 60
⅜, No. 21	4 90
⅜, No. 22	4 00
⅜, No. 23	4 15

Light Band.

1⅛ to 6 by ⅛ to 3-16 inch	1 60
1¼ to 6 by Nos. 11 and 12	1 65
1 to 1⅜ by ⅛ to 3-16 inch	1 65
1 to 1⅜ by Nos. 11 and 12	1 70
⅜ and 13-16 by ⅛ to 3-16 inch	1 80
⅜ and 13-16 by Nos. 11 and 12	1 75
¾ and 11-16 by ⅛ to 3-16 inch	1 90
¾ and 11-16 by Nos. 11 and 12	1 95
⅝ and 9-16 by ⅛ to 3-16 inch	2 05
⅝ and 9-16 by Nos. 11 and 12	2 10
½ by ⅛ to 3-16 inch	2 20
½ by Nos. 11 and 12	2 25

Wagon Box Iron.

⅛ inch, beveled edge, by Nos. 11 and 12	1 80
⅜ inch, " " " " 13 and 14	1 90
¼ inch, " " " " 11 and 12	1 95
¼ inch, " " " " 13 and 14	1 35

Sheet Iron.

No. 10	1 65
No. 12	1 70
No. 14	1 80
No. 15-17	1 90
No. 18	2 65
No. 20	2 20
No 22-24	2 30
No 25 26	2 40
No 27	2 50

Steel Boiler Plates—1-4 in. and Heavier.

Tank	1 45
Shell	1 60
Flange	1 70
Marine Flange	2 00
Fire Box	2 50

Above includes plates 90 inches wide.

90 to 96 in. wide	½c. lb. extra
96 to 100 in. wide	1 c. "
100 to 104 in. wide	1½c. "
104 to 106 in. wide	special

American Cast Tool Steel.

ROUND, SQUARE AND OCTAGON.	cts. lbs.
1 to 2 in. inclusive	68
9-16 to ⅞ in. "	65

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MANUFACTURERS OF

TIN AND TERNE PLATE, Iron and Steel Plates and Sheets, Plain Black, Painted, Corrugated and other forms of ROOFING, SIDING and CEILING. Patent Leveled Galvanized Sheets, BARS, Light Section Rails, ANGLES, Tees, Channels, and other Miscellaneous Bars and SHAPES.

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Special Wrought and Steel Chains of every description; Coil and Cable Chains; Chain Haulages for Coal Mines; Sprocket Wheels; Complete Coal and Ashes Handling Plants; Wire Rope Haulages and Wire Rope.

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POCAHONTAS FLAT-TOP COKE.

So low in ash that it requires no fluxing for foundry purposes. Our foundry and furnace coke was awarded the first premium at the World's Fair in 1893.

AVERAGE ANALYSIS OF COKE.

Moisture	00.196	Sulphur	00.677
Fixed Carbon	93.625	Ash	05.004
Volatile Matter	00.494		

Foundry, Furnace and all sizes of crushed coke. Guaranteed lower in Sulphur than any other commercial coke

STEEL CASTINGS

FROM 10 LBS. UPWARD.

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FRICTION CLUTCHES, HANGERS, PILLOW BLOCKS & PULLEYS.

Large Stocks on Hand. Shipments Promptly Made.

Subscribe for the Iron Trade Review, $3 per year.

7-16 to ⅜ and 2⅜ to 3 in.	.09
3⅜ to 4 in.	.09½
⅜ to 11-16 and 4⅛	.10
⅛ to 6 in.	.10½
⅛ to 9-32 and 6⅛ to 7 in.	.11
7 in	.13

Flats.

	cts. ₶s
2 to 9-16 in. wide by 2 to ⅛ thick	.8

Bessemer and O. H. Steel.

Bessemer Machinery	base price,	1 50
Open-hearth Tire	"	1 80
Open-hearth Spring	"	2 20
Sleigh Shoe	"	1 90
Toe Calk	"	2 10
Cutter Shoes, tapered and bent	"	2 20

English Tool Steel.

Jessop's	15½c
Hobson's "Best"	15½c
" "Choice"	35c

Burden Boiler Rivets.

½, ⅝, 11-16 and ¾ inches diameter	3 30
Bridge ½, ⅝, 11-16 and ¾ inch diam.	3 00

Wrought Pipe and Boiler Tubes.

Lap weld black, base	dis. 65
Butt " " "	dis.
Lap " galv. "	dis. 57½
Butt " " "	dis. 50
Boiler tubes 2¼" and smaller	dis 62½
Boiler tubes 2½" and larger	dis. 65
Casing screw and socket joint	dis. 52½
Casing inserted joint	dis. 47½

MACHINERY SUPPLY MARKET.

Anvils.

American	₶ lb 9@10
Wright's	₶ lb 12

Bellows.

Blacksmiths' Hill's	dis 40
Blacksmiths' Bullock's	dis 50&10
Moulders'	dis 40@40&10
Hand	dis 40&10@50

Belting.

Boston Belting Co.'s standard	dis 70
" " " extra	dis 60&5
" " " best	dis 55
Cleveland Rubber Co. extra standard	dis 60&10
Hoyt's Short Lap	dis 45
Shultz Raw Hide Leather Belting, single	dis 40
Munson's Short Lap Single Leather	dis 50
Munson's Short Lap Double and Light Double Leather	dis 50&10
Shultz Raw Hide Leather Belting, Double and Light Double	dis 40
Standard, oak tanned	dis 50&10
Alexander Brothers' pure oak tanned	dis

Blowers and Exhausters.

B. F. Sturtevant's	dis 20
Boston Blower Co.	dis 35
Buffalo	dis 40

Chucks.

Cushman's 4 Jaw Independent	dis 45
" Combination	dis 40
" Geared Scroll	dis 30
" 2 Jaw Brass Workers	dis 30
" Drill	dis 35
Wescott's Scroll Combination	dis 33⅓
" Independent	dis 40
" Little Giant Drill	dis
Horton's Universal	dis
" Independent	dis 45
Whiton's Independent	dis 45
National Combination	dis 40
Sweetland "	dis 40
Almond Drill	dis 20
Morse "	dis 15
Skinner's Combination Lathe	dis 40&10
" Independent Lathe	dis 40&10
" Universal Lathe	dis 40&10
" Drill	dis 20

Cutters and Reamers.

Cleveland	dis 10@15
Pratt & Whitney	dis 10@15
Standard	dis 10@15
Morse	dis 15
Brown & Sharpe, Milling Cutters	dis
" " Gear Cutters	dis

Crowbars.

Cast Steel	₶ 3½
Iron, steel points	₶ lb 3

Drill and Drill Sockets.

Twist Drills	dis 50&10
Morse Taper and Straight Shank to 1⅝"	dis 50&10
Morse Taper and Straight Shank Larger than 1⅝"	dis 25
Drill Sockets	dis 25
Standard Twist Drills	dis 55@55&5
Cleveland " "	dis 55@55&5

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BUILDING DEPARTMENT.

SPECIALTIES: STEEL AND IRON BUILDINGS FOR ROLLING-MILLS TIN PLATE PLANTS, STEEL WORKS, FOUNDRIES, FACTORIES, ROOF TRUSSES, GIRDERS, COLUMNS, BEAMS, CORRUGATED IRON, ETC.

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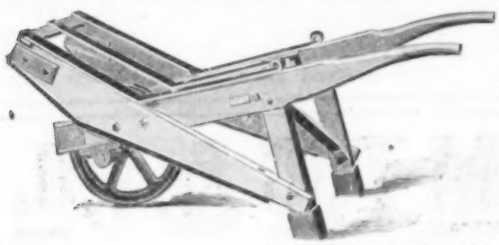
228 Lumber Exchange, Minneapolis, Minn.

PITTSBURGH OPEN HEARTH BARROW



Weight 160 lbs. The heaviest and strongest barrow made. Ironed with half inch iron. Cast iron shoes bolted on legs. The only barrow that will stand carrying pig iron or billets. It will be noticed by referring to dimensions below that the barrow, though so heavy, is very compact, so the load is easily managed. Furnished with 40 lb. Cast Iron Wheel.

DIMENSIONS. Handle, 54 in. long. Length of iron work on top, 34 in. Telegraph name, Scurvy. For wood and steel barrows, write for prices to

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A perfect smoke preventing furnace; perfect combustion, minimum of expense, simple in construction and economical.

A test of three tubular boilers of Cleveland Water Works, made Oct. 4th, 1895, by a waterworks engineer, shows an evaporation of over ten pounds of water to one pound of nut coal, and during the test the stack was entirely free from smoke.

The PLAYFORD STOKER CO., 919 SOCIETY FOR SAVINGS CLEVELAND, O.

Semi-Steel Castings

34,000 TO 38,000 TENSILE STRENGTH.

Process Owned by

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Cleveland Union Station.

Pennsylvania Lines.

Foot of Bank Street.

TICKET OFFICES at Station, Euclid Av., Woodland Av., and Weddell House corner.

THROUGH TRAINS RUN AS FOLLOWS BY CENTRAL TIME
* Daily. † Daily, except Sunday.

FROM CLEVELAND TO	LEAVE	ARRIVE
Pittsburgh and Bellaire	† 7:00 am	†12:10 pm
Salem and Pittsburg	* 8:00 am	* 8:30 pm
Pittsburgh, Bellaire and East	†12:45 pm	† 6:25 pm
Philadelphia and New York	* 1:40 pm	*11:25 am
Baltimore and Washington	* 1:40 pm	*11:25 am
Alliance and Pittsburgh	* 1:40 pm	*11:25 am
Ravenna and Alliance	* 5:00 pm	* 8:30 am
Philadelphia and New York	*11:10 pm	* 5:25 am
Baltimore and Washington	*11:10 pm	* 5:25 am
Alliance and Pittsburgh	*11:10 pm	* 5:25 am

Mt. Vernon and Pan-Handle Route

FROM CLEVELAND TO	LEAVE	ARRIVE
Xenia and Cincinnati	* 8:10 am	* 5:45 pm
Akron and Columbus	* 8:10 am	*5:45 pm
Akron, Columbus & Zanesville	†12:45 pm	†12:10 pm
Columbus and Cincinnati	* 8:00 pm	* 7:30 am

The Cleveland Terminal & Valley R. R. Co.

Depot foot of So. Water St.
City Office 137 Superior St.

	Arrive.	Depart.
Valley Jctn. & Way Stations	*6:30 P M	*7:10 A M
Akron, Canton & Valley	*10:10 A M	*3:15 P M
Akron, Canton & Chicago	*8:10 A M	*6:30 P M
Akron, Canton & Worcester, Defiance, Garrett, Marietta, Wheeling, Washington, D. C., and Baltimore	†2:55 P M	†11:00 A M

†Daily except Sunday. *Daily. Pullman's Palace Vestibule sleeping cars between Cleveland and Chicago.

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Emery.

	No. 4 to No. 54 46 gr.	150 gr.	Flour, C. F. F. FF.
Kegs, ℔ lb	4½c	5 c	2⅝c
½ kegs ℔ lb	4¾c	5¼c	2¾c
¼ kegs ℔ lb	5 c	5½c	3 c
10 lb cans, 10 in case	5 c	6¼c	5 c
10 lb cans less than 10	10 c	10 c	7½c

Emery Cloth and Paper.

Barder, Adamson & Co. ..... dis 50@50&5
H. H. Barton ..... dis 50@50&5

Emery Wheels.

Detroit ..... dis 60@70
Norton's ..... dis 60@70
Grant ..... dis 60@70
Sterling ..... dis 60@70
Celluloid ..... dis 10&33⅓
Northampton ..... dis 55
Crystal ..... dis 65@70
Vitrified ..... dis 60@70
Vulcanite ..... dis 60&10
Hamden ..... dis 60&10@70
Cyclone ..... dis 60@60&10

Files.

Arcade ..... dis 60&10@60&10&10
Nicholson ..... dis 60&10@60&10&10
" X. F ..... dis 25
Kearney & Foot ..... dis 60&10@60&10&10
Black Diamond ..... dis 60&10@60&10&10
McClellan ..... dis 60&10@60&10&10
Disston's ..... dis 60@70
Western ..... dis 70
Stub's ..... dis 25
Grobet's ..... dis 30
Reynolds Bros.' Hand Cut ..... dis 50
Industry File Works Hand Cut ..... dis 50

Hammers.

P. S. W ..... dis 40
Atha new list, Jan. 15, 1887 ..... dis 50
Heavy hammers and sledges under 5 lbs 12c
" " " " over 5 lbs 10c

Jack Screws.

Illinois Bolt Co. list ..... dis 75

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5½	4¾	4	3⅜	3⅛
Hexagon	15⅝	11⅛	8⅜	6	5⅛	5¼	
Washers	9	8	7	5	4½	4⅜	4¼

In lots less than 100 lbs, ℔ lb add ½c., 1 lb boxes add 1c to list.

Nails (wire).

List July 14, 1887 ..... dis 85
Standard Penny Nails, ℔ keg card rate
Car lots $2 75
Less than car lots $2 35

Oilers.

Zinc and Tin ..... dis 60
Brass and Copper ..... dis 50
Malleable (Hammer'd), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ℔ doz ..... dis 10&10&10

Picks.

Railroads, 5 to 6 lbs ..... $12 dis 60
" 6 to 7 lbs ..... $13 dis 60

Pulleys.

Iron Pulleys, Walker List ..... dis 50
Medart Pulleys ..... dis 50
Split Wood Pulleys ..... dis 55@60

Pulley Blocks.

Moore's Anti-Friction Differential Chain Pulley Block ..... dis 20

Rivets.

Iron, Thousand, list November 1, 1894 ..... dis 60@65
Iron, Ordinary, Cooper's Block and Carriage list November 1, 1894 ..... dis 60@65
Copper ..... dis 50@50&10

Taps.

Cards, Hand and Nut to 2 in 1s 50
Carpenters' " " " ..... dis 50
Morse " " " ..... dis 50
Pratt & Whitney " " new list ..... dis 10
Machine Screw Taps ..... dis 55
Pipe Taps to 2½ in ..... dis 70
Stay Bolt Taps ..... dis 25
Stove Bolt Taps ..... dis 55
Pulley Taps ..... dis 40

Vises.

Solid Box ..... dis 60
Parker's ..... dis 20@25
Prentiss ..... dis 20
Stephen's ..... dis 25@30
Barrett's ..... dis 30
Miller's Falls ..... dis 40
Merrill's ..... dis 15@20
Howard ..... dis 35

Wire.

New List, Apr. 9, 1894

Brass ..... dis 40
Copper ..... dis 40
Bright and annealed, Nos. 0@18 ..... dis 70&10&10&5
" " Nos. 19@26 ..... dis 75&75&5
" " Nos. 27@36 ..... dis 75&10&5
Coppered Nos. 0 to 18, market list ..... dis 70&70&5
Galvanized Nos. 0 to 18 " " ..... dis65&5
Tinned market Nos. 0 to 18 ..... dis 6¾
Cast steel ..... dis 50
Tinned Broom Wire ..... dis 70&50&70&10
Annealed Fence, Nos. 8 and 9 ..... dis 75
Annealed Grape, Nos. 10 to 14 ..... dis 75
Stub's Steel Wire regular ..... 95c ℔ lb dis 30

Wrenches.

Coe's genuine ..... dis 50
Girard Standard ..... dis 70&10
Agricultural ..... dis 75&10
Mechanic's ..... dis 55&10&5
Bemis & Call's Combination ..... dis 35
Donohue's Engineers ..... dis 20&10
Lamson & Sessions Engineers ..... dis 65
Billings & Spencer's Drop Forged ..... dis 25
William's " " ..... dis 20
Alligator " " ..... dis 40

Perforated Filter Press Plates.

THE HARRINGTON & KING PERFORATING CO. CHICAGO.

BRONZE SCREEN PLATES To withstand action of ACIDULATED WATERS.

PERFORATORS OF STEEL, IRON, COPPER, ZINC, BRASS AND TIN.

For use in GRAIN CLEANING AND MINING MACHINERY, WOOLEN, COTTON, PAPER AND PULP MILLS, RICE, FLOUR AND COTTON SEED OIL MILLS, SUGAR AND MALT HOUSES. DISTILLERIES, FILTER PRESSES. STONE, COAL, AND ORE SCREENS, BRICK AND TILE WORKS, FILTERS, SPARK ARRESTERS, GAS AND WATER WORKS, OIL, GAS AND VAPOR STOVES, COFFEE MACHINERY, ETC.

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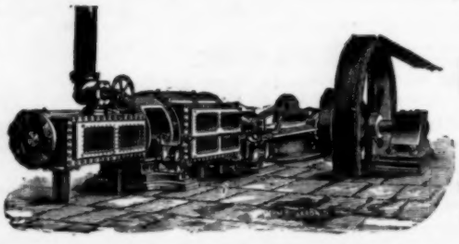

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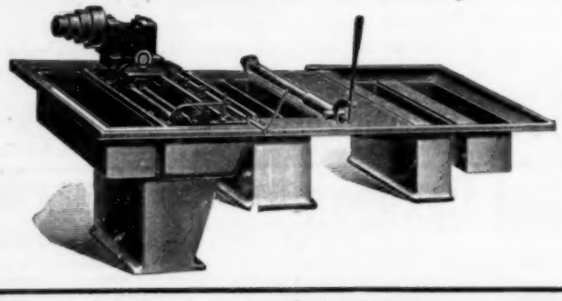

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STERLING EMERY WHEEL MFG. CO.

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Hot Blast (or Graphite) Pyrometer.—The only stationary Pyrometer now in use durable over 700 degrees.

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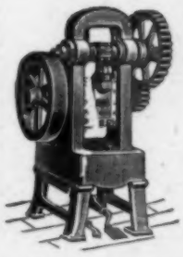

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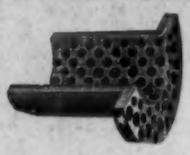

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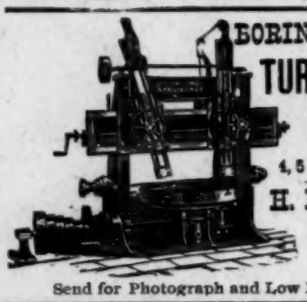

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